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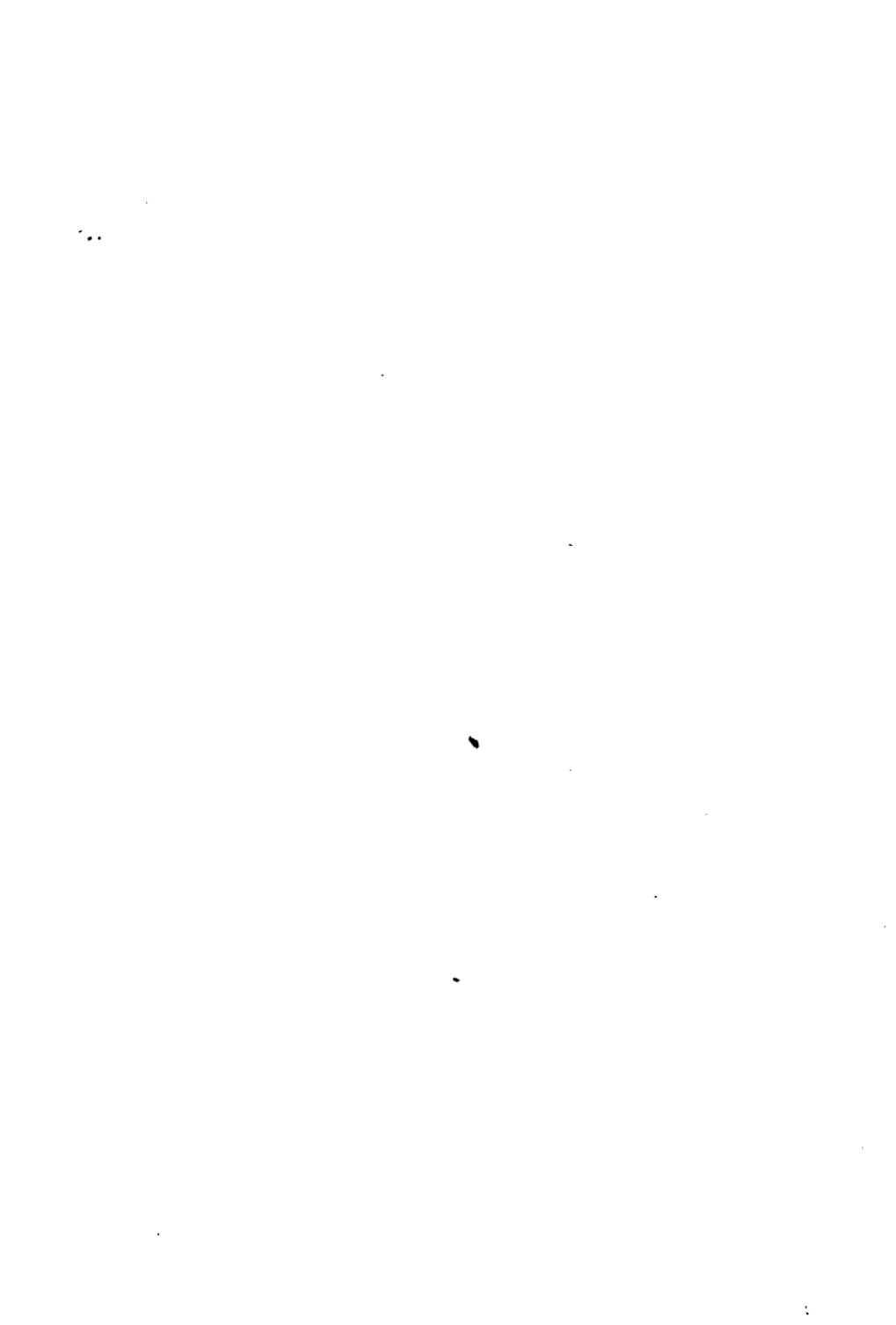
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BLOOD PRESSURE
TECHNIQUE SIMPLIFIED



J. L. C. H. B. S.

BLOOD PRESSURE

TECHNIQUE SIMPLIFIED

C
W. H. COWING, M. D.



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INTRODUCTION.

The Taylor Instrument Companies, in presenting this work, feel that some explanation in connection therewith is desirable.

For some time past, having been brought in close contact with the profession through demonstrations, the demand for a simple, practical book on Blood Pressure and Sphygmomanometry has been an ever-increasing one.

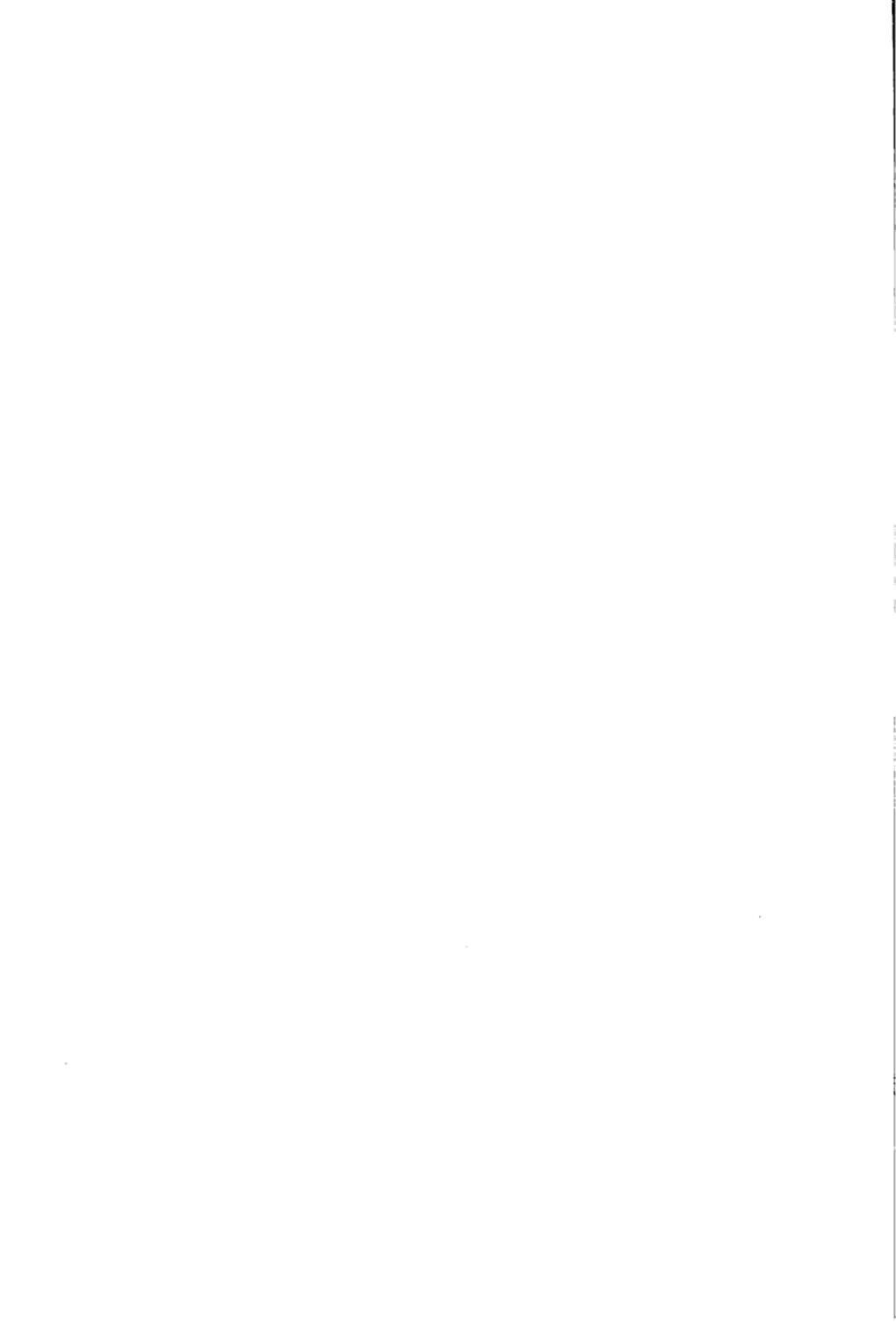
In the preparation of this work commercialism has been disregarded, and it is felt that the strictest code of ethics has been conserved throughout.

The author has had exceptional and peculiar advantages in the study of this subject, as for a long period it has been his pleasure to come in contact with specialists, leading members of the medical profession, and the chief medical examiners for many of the largest life insurance companies, and in such association the discussion has invariably been on Sphygmomanometry, Blood Pressure and its relation to disease, surgery and life insurance examinations.

No attempt has been made to produce a work for the specialist, but to give, in a modest way, to the general practitioner who may not be thoroughly informed in blood pressure work, some observations of the writer and men who are eminent in this field of work, hoping it may be of use to him in his daily routine work.

W. H. COWING, M. D.

Rochester, N. Y.



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BLOOD PRESSURE TECHNIQUE SIMPLIFIED

Harvey first discovered the circulation of the blood, which was followed, after several years, by the demonstration of blood pressure, in 1733, by Hale. Since that time men of research have persistently and diligently endeavored to acquaint themselves with every condition of the circulatory system.

In 1828, Poiseuille and Ludwig brought out the first U-shaped manometer for the determination of blood pressure. From that time onward up to about ten years ago, there were many forms of instruments produced, some to live and some to die out. It is safe to say that about ten years ago came the first true realization of the great importance of determining the actual blood pressure in disease. Since that time, interest in this important subject has been daily increasing, and various instruments for the determination of blood pressure have increased proportionately, until at the present time, we are amply able to accurately determine existing blood pressure by the use of the Sphygmomanometer.

Blood Pressure always depends upon four factors:

1. Cardiac energy.
2. Peripheral resistance.
3. Elasticity of the arterial walls.
4. The amount of blood in circulation.

These vary somewhat in normal cases, and in pathologic cases the variance is very great, but by the use of the Sphygmomanometer the exact variation can be accurately ascertained, and the effect of medication or treatment on a pathologic condition will be shown in every Sphygmomanometer reading by increase or decrease in pressure.

Increased blood pressure is a premonitory indication and forerunner of subsequent changes in cardio-vascular renal disease.

The blood pressure varies within wide limits, according to the position of the body, muscular exertion, excitement, anger, passion, nerve tension, digestion, etc., and differs in the same individual in different vessels and at different hours, and allowance must be made for arms of different sizes.

It is certain that no pulse taking or other test will give so accurately equal information.

The best possible time to take blood pressure will be about $1\frac{1}{2}$ to 2 hours after eating, with the patient in a recumbent position. If it is impossible to have the patient lie down, as it sometimes is in office work, they should be seated in an easy position, with the left arm extended and resting on something as nearly on a level with the heart as is possible, and fully reposed.

It is maintained by many authorities, and is undoubtedly true that the most exact blood pressure readings can be obtained from using the femoral artery.

Pressure readings are always higher when standing than sitting, and higher sitting than reclining, the difference being from 4 to 8 millimeters in each change of position.

It is also absolutely necessary for an accurate reading, that the patient's mind be thoroughly at ease at reading, for functional disturbances of any kind greatly increase the maximal pressure.

In taking blood pressure readings on the same patient for a protracted time it is well to chart the findings, trying to take each reading as near as possible at the same time each day, and under conditions as near alike as possible.

The value of diagnosis and prognosis of a positive determination of the condition of blood pressures, involving maximal, minimal and pulse pressure, is thoroughly recognized, but the necessity and great importance of blood pressure examinations as a matter of daily routine work cannot be too strongly emphasized, for in this way, and in this way only, are we able to foretell on-coming conditions and guard against them. An indication of disease, by proper treatment, may prevent the development of a pathologic condition.

Increased blood pressure, if not sustained, but intermittent, is not disease, but it is a very positive indication that the sequel will be disease if the condition is not taken in hand at once and corrected. The physician, therefore, is forewarned of impending danger and is given a chance for prophylactic and curative

treatment that he otherwise would not have had, had he not used a Sphygmomanometer. All conditions having a sustained pressure of 100 mm. or lower, or 150 mm. or over are truly pathological cases and need thorough investigation and treatment.

The most important thing of all to remember in diagnosis and treatment of this disease is that the Sphygmomanometer reveals symptoms of cardiac or kidney lesion before a murmur can be heard or a trace of albumin found. It will show toxic blood conditions that lead to cardiac or kidney disease long before any evidence of anything wrong would be discovered.

There are two methods of determining blood pressure, that by oscillation and that by auscultation.

We will first describe the method by oscillation.

Place the bag over the arm with the two tubes well under the arm and over the brachial artery. Wrap the remainder of the sleeve around the arm much the same as you would apply a bandage, tucking at least six inches of the sleeve under the last fold. Then place the Sphygmomanometer in one tube and the bulb in another and you are ready for reading. Care should be taken not to put the sleeve on tight enough to cause any apprehensive feeling in the patient.

Place the finger lightly over the radial artery and send the pressure in the cuff to the point where the pulse has entirely disappeared, then

advance the hand about 2 cm. above this point of disappearance, then release the air gradually and note the first perceptible pulse wave felt by the palpating finger at the wrist. This represents the true systolic or maximal pressure.

Having now obtained the systolic or maximal pressure, release the air gradually by means of the escapement valve, and note where the largest oscillation or movement of the hand takes place, and the lowest point of this largest oscillation is the diastolic or minimal pressure.

For example,—If the largest oscillation occurred between the divisions 90 to 96, 90, being the lowest, would be the reading.

It is well to bear in mind to keep the eye concentrated on the scale divisions, for the travel of the hand can be accurately determined when this is done.

In determining systolic (maximal) pressure, the pulse becomes more feeble as the pressure advances, and when taken with the ends of the fingers, the pressure of the fingers is involuntarily increased, so that a very sensitive pulse may be closed off entirely by the finger pressure; while if taken with the ends of the fingers resting on the upper curve of the bone of the wrist, permitting the balls of the fingers to rest lightly over the radial, thus bringing in contact with the pulse the most sensitive part of the fingers, any extra pressure that might result would be directed against the bone and not the pulse.

Method by Auscultation: This is by far the most accurate method of determining the blood pressure, and the results obtained in this way should be free from error, or the dangers of personal equation in palpating the artery at the wrist.



Systolic or Maximal Pressure: Bare the arm and adjust the sleeve well up; place the stethoscope over the Brachial artery about 1 cm. below the border of the cuff, then constrict the arm by inflating the bag until no sound is heard in the artery through the stethoscope. At this point release the air slowly by means of the escapement valve, and soon a clear, clicking sound will be heard, which indicates the first passage of the blood stream below the constricting arm band and is the true systolic or maximal pressure.

Diastolic or Minimal Pressure: Still gradually releasing the air, this clear, clicking tone (first phase) is followed by a low tone or murmur (second phase), and this murmur is fol-

lowed by a loud, clear tone (third phase), this in turn by a perceptibly dull tone (fourth phase) and this dull tone represents the diastolic or minimal pressure.

Below is given the five different phases of tone to be heard in the ausculatory blood pressure phenomena as found by Louis M. Warfield, A. B., M. D., and confirmed by his clinical observations on animals.

The first phase is due to the sudden expansion of the collapsed portion of the artery below the cuff, and to the rapidity of the blood flow. This causes the first sharp clicking sound which measures the systolic pressure.

The second, or murmur and sound phase is due to the whorls in the blood stream, as the pressure is further released and the part of the artery below the cuff begins to fill with blood.

The third tone phase is due to the greater expansion of the artery and to the lowered velocity in the artery. A loud tone may be produced by a stiff artery and a slow stream or by an elastic artery and a rapid stream. This tone is clear cut and in general is louder than the first phase.

The fourth phase is a transition from the third and becomes duller in sound as the artery approaches the normal size.

The fifth phase, no sound phase, occurs when the pressure in the cuff exerts no compression on the artery and the vessel is full throughout its length.

It is generally conceded that the sounds heard are produced in the artery itself and not at the heart.*

Lang & Manswetowa in 1908, compared the Auscultatory method with the apparatus of von Recklinghausen, and found uniformly that the diastolic pressure was marked by the point at which the second clear tone took on a dull character.

Hoover, Warfield and Dehio came to the same conclusion, the first by comparing the Auscultatory method with the mercurial manometer, the second with the Sphygmograph, and the third with the Erlinger apparatus.*

The above method cannot be employed where aortic insufficiency exists or where there is a dilatation of the vessels. These conditions being observed, when the pressure is first increased on the brachial, as soon as a slight pressure is placed on the artery, a pistol-shot tone is heard, and will continue with but little variation throughout the observation. When this condition exists it is absolutely necessary to resort to the oscillatory method. It is also necessary to use the method by oscillation when the pulse is feeble.

Having now accurately determined both Systolic and Diastolic Pressure, we come to another very important factor in blood pressure and that is called the pulse pressure and is ob-

*Arterio Sclerosis by Louis M. Warfield, page 83.

*Taussig-Cook, Archives of Internal Medicine.

tained by subtracting the Diastolic pressure from the Systolic. For example:

Systolic Pressure	120
Diastolic Pressure	80
Pulse Pressure	40

Dr. Hirschfelder of Johns Hopkins Hospital has found the pulse pressure in normal readings to be from 30 to 45 mm. Dr. L. M. Warfield, Wisconsin College of Physicians & Surgeons has found in his experiments the pulse pressure to be from 45 to 48 mm. The writer has found in a series of observations 25 to 45 mm. to be more common. It is well to remember that any readings taken by the auscultatory method, the systolic pressure is a trifle higher and the diastolic a trifle lower than readings taken by the palpitory or oscillatory method. The pulse pressure normals given above were obtained by the auscultatory method. Dr. Willard R. Stone as the result of extended research finds in normal cases that the pulse pressure equals 50 per cent of the Diastolic pressure, and this without doubt is an excellent working hypothesis.

However, any pulse pressure below 20 or above 40 is ground for investigation, for it suggests either hypertension or hypotension.

In the past there has been but little said regarding the diastolic pressure, presumably for the fact that to determine diastolic pressure accurately with a mercurial instrument is an impossibility, because mercury requires $1\frac{1}{2}$ seconds to recover itself, while in one second we

have had $1\frac{1}{4}$ heart impulses. Without a correct diastolic, as you can see, it would be impossible to obtain a correct pulse pressure.

Pulse pressure plays a very important part in blood pressure, as it shows not only heart impulses, but it also shows conclusively the effect and distribution of the treatment. For instance, if you have a patient with a high systolic and a low diastolic, showing a long range of potential difference or pulse pressure, a decrease of this pulse pressure to nearer a normal condition (25 to 40), shows that the condition is being overcome and that a circulatory equilibrium is being established, and vice versa in the case of wasting diseases, a pre-tubercular condition, etc., where the pulse pressure is small, the increase in pulse pressure again shows the effect of medication and treatment.

Another important factor in pulse pressure is that if the difference between the diastolic and systolic is normal (26 to 36) it shows that the heart impulse is normal, and therefore the condition is a compensated one.

The writer wishes to emphasize one thing right here, and that is this, that in the past the average physician has paid too little attention to two of the most important factors in blood pressure, and that is the diastolic and pulse pressure.

The physician that contents himself with simply taking the systolic pressure, is really not making a blood pressure observation, he is simply doing only one-third of it, and the informa-

tion he has gained by taking the systolic pressure alone, really amounts to very little, for it simply shows the maximal pressure only, which at its best varies greatly under conditions which are by no means abnormal. On the other hand the diastolic pressure is practically a constant one and shows the true pathological condition of the artery and the amount of peripheral resistance that the heart must overcome in order to carry on its work.

*Therefore (page 78 Warfield) it is most important to estimate accurately the diastolic pressure as well as the systolic pressure, for only in this way can we obtain any data of value regarding the driving power of the heart and the condition of the vaso motor. A high systolic pressure does not necessarily mean that a great deal of blood is forced into the capillaries.

Actually it may mean that very little blood enters the periphery. The heart wastes its strength in dilating constricted vessels without actually carrying on the circulation adequately.

The pulse pressure is the difference between the diastolic and systolic pressure, and practically represents the heart load.

Dr. Willard J. Stone, of Toledo, O., in a very able paper read at the American Medical Association Convention describes his findings in 170 cases as follows:

"The determination of systolic and diastolic pressures by the auscultatory method was to be preferred to the palpitory method for systolic,

*Arterio Sclerosis, by Louis M. Warfield.

and column or indicator oscillation for diastolic pressure, because of greater accuracy.

(2) The readings were slightly higher by the auscultatory than by the palpitory method.

(3) The pulse pressure measured the energy of the heart in systole in excess of the diastolic pressure. For clinical purposes it represented the load of the heart. Under normal conditions it was approximately 50 per cent of the diastolic pressure. The myocardial load might, therefore, be expressed

$$\text{by the fraction } \frac{\text{pulse pressure}}{\text{diastolic pressure}} \text{ or } \frac{\text{P. P.}}{\text{D. P.}}$$

(4) Since the diastolic pressure measured the peripheral resistance it was a better index of hypertension than the systolic pressure. A sustained diastolic pressure of 100 to 110 signified hypertension. The diastolic was less influenced by physiological factors than the systolic pressure.

(5) The comparison between systolic, diastolic, and pulse pressures was of clinical value in the interpretation of circulatory changes and of more importance than the estimation of systolic pressure alone.

(6) In arterial hypertension and myocardial decomposition in the broad sense, the pulse pressure and heart load was increased, as a rule, the overload factor varying greatly from 50 per cent to 175 per cent in this series. The greater the overload factor the greater was the danger of myocardial exhaustion.

(7) In circulatory failure due to shock, to many acute infections, and to hemorrhage, the pulse pressure was low. This was the result, it was believed, of factors which had influenced arterial tonus and peripheral resistance with rapid pulse rate, increased respirations and lowered venous pressure.

(8) In acute infections, a sustained pulse pressure warranted a more favorable prognosis, as a rule, than a low pulse pressure, other things being equal; although the change from a normal to a low pulse pressure in circulatory failure might occur very rapidly. As a rule the lower the pulse pressure, the greater the danger of circulatory failure.

(9) From this point of view low pulse pressure in circulatory failure involved a consideration of complex peripheral changes in addition to the myocardial factor.

(10) The pulse pressure multiplied by the pulse rate did not give a reliable index of systolic output in circulatory shock since the pulse rate clinically increased out of proportion to the fall of the pulse pressure. This shortened the time during which the left ventricle was filled during diastole and lessened the systolic output although by the formula pulse rate multiplied by pulse pressure the unit volume output might appear to be increased.

(11) The pulse pressure estimation in this series did not show marked variations from day to day, except in a few more or less neurotic individuals.

The use of the Sphygmomanometer to the careful and conscientious physician is fully as essential as the stethoscope or clinical thermometer, for by the use of this instrument he can not only make his diagnosis, but can watch the effect of his treatment, which renders the prognosis infinitely better.

Take, for instance, diagnosis by the process of elimination. The reader knows the factors which cause high and low blood pressure to be indicative of trouble. Now, if he can eliminate one factor after another until he has reached that one which will not permit of elimination, he is much sooner at the cause of his trouble than he would be by any other diagnostic method at his disposal, and can fully watch the effect of his treatment on the existing condition.

Another factor to take into consideration in using the Sphygmomanometer is to carefully watch the action of the hand as you go from the systolic down to the diastolic pressure, for any intermittent action or cardiac disturbance will be shown by the erratic action of the hand, oftentimes when no such action can be determined by either the stethoscope or pulse.

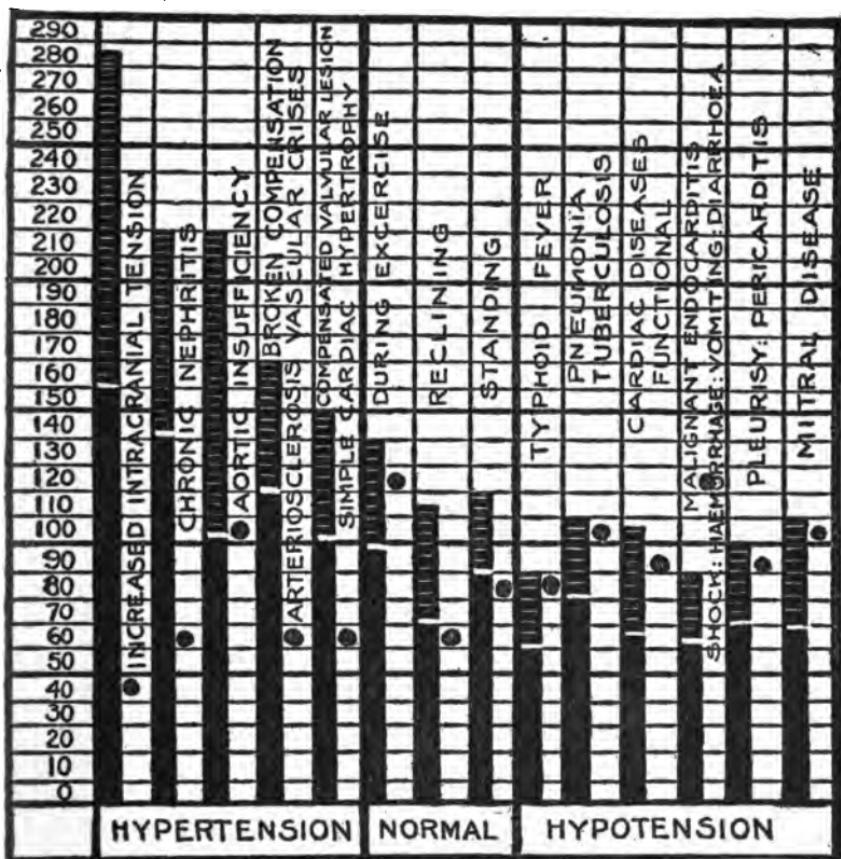


Diagram showing typical blood pressures in various diseases. Solid black, minimal pressure; striped shading, pulse pressure; dot, pulse rate.

—Hirschfelder.

"Diseases of the Heart and Aorta." J. B. Lippincott & Co., Philadelphia, Pa.

The arbitrary blood pressure normals as observed by many writers are as follows, in

TABLE No. 1

18 to 40 years of age	121 mm.
40 to 50 years of age	130 mm.
50 to 60 years of age	138 mm.

The writer, however, has, in a series of some 5,000 observations, found the following to be more common, as in

TABLE No. 2

Children from 10 to 17 . . .	85 to 110 mm.
Adults from 21 to 40 . . .	120 to 130 mm.
Adults from 40 to 50 . . .	130 to 135 mm.
Adults from 50 to 60 . . .	135 to 145 mm.

Dr. Woley in the study of 1,000 healthy male cases found the average systolic pressure at all ages about 127 mm. Trumpp has found the blood pressure in infants to be about 80 mm. In early childhood and through the first decade it is usually below 90 mm. and before puberty ranges between 90 to 110 mm.

It is well to remember that there is an ever-increasing hardening of the arteries as one grows older, and a person of 65 or over can very easily have a blood pressure of 160 and still be a comparatively healthy individual. Female pressure is 8 mm. lower than that of males. Any blood pressures, however, between the ages of 21 and 50, lower than 100 or higher than 150, can safely be termed pathological cases.

BLOOD PRESSURE AND PHYSICAL EXERCISE

In the average normal adult indulging in a moderate amount of physical exercise, the blood pressure is temporarily raised, but soon returns to normal, after rest.

However, if the exercise be too strenuous, the blood pressure will fall at the termination of the exercise and will not return to a normal condition until about 30 minutes.

In athletes who train for and take part in marathon, bicycle and running races, etc., the pressure has been found to be about 20 to 30 millimeters lower after the race than at the beginning, but it usually comes back to normal within an hour.

The Sphygmomanometer, as an indicator to the physical instructor, to show whether a man is physically fit for exercise and for how much, is obvious.

*In an article on Blood Pressure in Hypertrophy and Dilatation of the Heart, Dr. Joseph H. Barach, Pittsburgh, says as follows:

"At the meeting of last year, I presented for the consideration of this section, some observations on the circulatory system of individuals who had passed middle life. Today, I offer for your consideration, results of a series of observations upon youths and men who have not yet reached the middle period of life. These observations were made upon a series of over 50

*Penn. Med. Journal, Athens, Pa., May, 1911.

young men who represent, in physical vigor, the pick of our community. Most of them in the course of a year added to the daily demand of their vocations an extra amount of physical exertion in the way of distance running, and at the end of that time presented the conditions which are here to be considered in brief. This is essentially a study of hypertrophy and dilatation of the heart in its pure form.

"The onset of hypertrophy is of a comparatively short duration. My observations showed that a marked degree of physiological hypertrophy may develop within six or nine months, and that the degree of its development will be in proportion to the amount of exertion and the persistency with which it is continued. Of course, the inherent quality of the heart-muscle fibre of each individual will act as the primary factor in determining the possible degree of hypertrophy and the length of time in which it can be developed.

"Age has its influence. While hypertrophy may develop at any age, it reaches its greatest degree in the first half of life. Long working hours and laborious occupations have a marked influence, and our observations also tend to show that the habitual taking of large quantities of food and liquid is a potent factor in the development of the greater hypertrophy.

"What are the manifestations of this physiological hypertrophy and how may its presence be determined?

"Subjectively, there are but few evidences of the existence of this condition. The individual finds himself able to endure such physical exertion as he could not before this onset. Occasionally, we may feel or hear his heart beat at the beginning or end of the exertion. Aside from these there are no subjective evidences. Objectively, we find, upon physical examination of most of these subjects, a hypernormal, visible and palpable apex impulse. Percussion reveals an increased area of dullness, mostly to the left, and with the fluoroscope, there is to be seen a heart shadow, the outline of which is larger than the average. This shadow extends further downward and is distinctly more to the left than normal.

"Upon auscultation there is heard a strong deliberate, clear sound at each of the cardiac areas. The pulse rate is moderate and slower than the normal average, and there is a normal diurnal variation. The maximum and minimum blood pressures are distinctly higher than the normal average. Should the effect of changes of posture be studied in such a case, it will be found that if the patient changes from the horizontal to the erect position, there is a rise in the pulse rate. The maximum pressure may be increased or diminished. The minimum pressure will be diminished or remain equal, and with these changes, the pulse pressure in over one-half of the cases will fall.

"In a certain number of the subjects that failed to develop a marked degree of hypertro-

phy, the pulse pressure, after this change of posture, was almost invariably diminished. If the daily effort has been more strenuous the hypertrophy will be greater and its manifestations more pronounced. In this series, those who had murmurs at one or other of the cardiac areas before the race were those who showed the largest heart shadows. They also had a greater diurnal variation of the pulse and a greater number of heart beats within each 24 hours. After going through functional tests, their heart sounds, especially at the base, partook of the quality called accentuation.

"The blood pressure level of these heart murmur cases was markedly higher than in the ones that showed but an average degree of hypertrophy.

"Such are the findings in the pure form of cardiac hypertrophy.

"The occurrence of cardiac dilatation from overstrain, as is well known, may come on after repeated daily overstrain or after one overwhelming effort. Here we will concern ourselves with the dilatation produced in the latter way, a form from which the average athlete of this series recovers within a variable period of days or weeks, and is therefore to be considered as transitory cardiac dilatation.

"The inciting cause of the cardiac dilatation in this instance was a run of 24.85 miles. This included a climb of four hills, which were 510, 310, 120 and 190 feet in height. This was accomplished by most of the men in four hours and

fifteen minutes. Of the 12 men who performed this physical feat, 11 showed a marked increase of heart shadow, i. e., they had a distinct dilatation of the heart. The other one of the 12, who was pronounced the best trained of all and who had been practicing long distance runs for nine years, did not show dilatation or even a marked increase in pulse rate. Of those who were examined with the fluoroscope, there were two who ran but 11 miles. Apparently they did not overstrain their hearts for they showed no dilatation. We see, then that whenever physical effort was carried to a degree of cardiac overstrain dilatation followed. When the efforts ceased before overstrain occurred dilatation was not induced. In nine out of the eleven cases, this dilatation involved all the chambers of the heart. In one it seemed limited to the right ventricle and in another to the left ventricle.

"The evidences of cardiac dilatation, beside the increase in the size of the heart shadow, were enlarged areas of cardiac dullness; small, feeble, and rapid pulse; in some cases, arrhythmia, and in others, heart murmurs, which were not present before the race. There is usually marked dyspnea. There may be intense distress from agonizing precordial pains, and in some cases distinct mental symptoms occur, which in part, at least, are dependent upon disturbed circulation. The blood pressure behaves in a characteristic way, and the maximum and minimum and pulse pressures each show a

marked fall, and the total fall is in proportion to the degree of dilatation as seen from the fluoroscope screen.

"On observing the effects of change of posture during this change in dilatation, we found that with the change from the horizontal to the erect there was a fall in all pressures, as quite to be expected when the cardiac energy of the heart had been severely taxed.

"All this is interesting to us as medical practitioners inasmuch as it reflects upon the pathological physiology of diseases of the circulatory system, and these observations do in a very suggestive way.

"The development of this pure form of hypertrophy and dilatation serves as a prototype of the hypertrophy and dilatation that results from various diseased conditions.

"There is nothing more important, and few things are more common, than cardiac overstrain and dilatation, whether the overstrain be the result of external or internal causative factors, whether it be from repeated daily overstrain or whether it be the result of one overwhelming effort."

INSURANCE AND BLOOD PRESSURE

Almost all the insurance companies now require an examination for blood pressure, some of them for policies of \$5,000 or over, or for any person of the age of 40 or over. Others require a blood pressure reading on all applicants irrespective of the size of the policy desired or the age.

They also require the use of a cuff having a surface presentation of 12 centimeters. The importance of examination is manifest, for a person with a pathological blood pressure is certainly a poor business risk for any insurance company.

To a great extent insurance companies have only asked for the systolic pressure, but as they go more carefully into the matter they will find that by determining only the systolic pressure they are in great danger of accepting risks that they should not, as, for instance, an applicant with a predisposed tubercular condition might easily show a normal pressure.

*Dr. Haven Emerson says: "Hypotension is found in almost all cases of moderately advanced tuberculosis, or in early cases in which the toxemia is marked, except when arterio sclerosis, the so-called arthritic or gouty diathesis, chronic nephritis or diabetes, complicate tuberculosis and bring about a normal pressure or hypertension. Occasionally the period just preceding an hemoptysis, or during an hem-

*Archives of Internal Medicine, April, 1911.

optysis, may show hypertension in a patient whose usual condition is that of hypotension."

But upon examination for minimal pressure showing a pulse pressure of below 20 millimeters would indicate a serious pathological condition, which would require investigation. It is always well, when there is any doubt as to the pathological condition of the applicant, to keep him under observation for some time, recording both systolic, diastolic and pulse pressure observations, that the true condition may be learned before issuing a policy. The danger of accepting applicants who are not really entitled to insurance is greatly lessened by the determination of the pulse pressure and no insurance company desires to refuse a policy to a good risk, and in no way can this be positively ascertained except by the use of the Sphygmomanometer.

Dr. H. P. Woley, medical director of the New York Life Insurance Company in Chicago, in his monograph on "The Normal Variation of the Systolic Blood Pressure—A Study of One Thousand Cases," says:

"The practice of taking blood pressures in insurance examinations has become comparatively common in the last few years. The question was soon asked: What is the normal blood pressure? Is the blood pressure different at different ages, and, if so, what is the difference? We all know that the pulse may fluctuate between certain limits, say 60 to 85,

and still we would not hesitate to say that a person between these limits was in health. If it is beyond either limit we would make a further study of the case, fearing that it might be a pathologic condition.

"The medical examiner, from the insurance standpoint, is in an opposite position from the practitioner in his office, as the latter is dealing almost entirely in cases in a pathologic condition, while the insurance medical examiner is dealing with healthy persons, and is trying to find how far their cases may deviate from the normal typical cases and still be healthy and a first class risk.

"He is trying to establish boundary lines, a high and a low mark, within which the applicants may be safely considered in health and outside of which they would be looked on with suspicion.

"With these ideas in view, I have collected during the past three years the readings of 1,000 blood pressures, all of supposedly healthy individuals. There has been excluded every case of kidney disease and heart disease, in fact every case in which there was a pathologic condition found, either from physical examination or from the history. These cases represent typical, healthy individuals ranging in age from 15 to 65. These records were all taken by five different physicians. Often they were taken by two physicians working together. Again records were made at the same sitting with two different instruments, for instance, the mercury column

and the Dr. Rogers' "Tycos" Sphygmomanometer. From time to time the instruments were corrected or standardized by subjecting them to the same pressure and then the reading taken.

"This was done by using the usual 5-inch cuff, but one having several openings or rubber tubes, to each of which a Sphygmomanometer was attached. When the pressure was raised in the rubber bag an equal pressure was made at the same time on other instruments. This was done to reduce the liability of error and to secure, as far as possible, an accurate and uniform reading.

"All the results herein recorded were made by using a 5-inch cuff about the arm of the subject in a sitting posture, and the systolic reading taken at the point at which the pulse disappeared and reappeared with the finger on the radial artery.

"In a comparison and study of many cases in the last five years, I believe that at any age a constant blood pressure of 160 millimeters or over is pathologic, and therefore should be excluded from forming any part of the results or conclusion reached in this paper. Many of these cases have been studied where it was possible, and albumin and casts have been found in the urine sooner or later, although sometimes in small amounts. It explains the condition, however. This has been of considerable value, as many risks might have been accepted as first-

class were it not for the abnormal elevation in blood pressure which led to a further study.

"Experience has taught us that the selection of a single individual's blood pressure, as a high mark or a low mark, will be manifestly unreliable, while it is equally certain that the general average of a group of blood pressures will give pretty nearly the truth. The larger the group the more accurate the results.

"It is found to be practically correct in considering vast numbers of supposed healthy individuals that about 85 per cent. prove to be healthy and 15 per cent. are questionable.

"Following this principle I shall take the general average of the group of 15 per cent. for the highest blood pressure, and the general average of the group of 15 per cent. for low blood pressure, and designate them as average high and average low blood pressure. With this explanation the results reached after a study of 1,000 blood pressures are as follows:

"The average blood pressure of all ages was 127.5 millimeters. The average blood pressure for females at all ages was 120 millimeters. By taking them in groups from 15 to 30, the average blood pressure was 122 millimeters, the average high blood pressure being 141 millimeters and the average low 103 millimeters.

"Second: Those from 30 to 40 years of age gave an average blood pressure of 127 millimeters, an average high of 143 millimeters and an average low of 107 millimeters.

"Third: Those from 40 to 50 years of age

gave an average blood pressure of 130 millimeters, an average high of 136 millimeters and an average low of 113 millimeters.

"Fourth: Those from 50 to 60 years of age gave an average blood pressure of 132 millimeters, an average high of 149 millimeters and an average low of 115 millimeters.

"There is a gradual rise in blood pressure as the years advance. There is also a corresponding rise in the high and low averages. It can readily be seen that between 50 and 60 years of age a man giving a blood pressure of 145 millimeters would undoubtedly be accepted without further question, while a man under 30 years of age, showing the same pressure, would present a case for further study and investigation.

"I have selected a group from 55 to 65, which gives an average blood pressure of 138 millimeters, an average high of 153 and an average low of 120.

"There are a few points worthy of notice that might be mentioned here, namely, in regard to the pulse, rapid or slow. The average blood pressure in all cases with a pulse under 65 was 123 millimeters, while the average blood pressure in all cases with a pulse over 85 was 130 millimeters.

"It was also noticed that there were quite as many healthy individuals with a pulse over 85 as there were with a pulse under 65."

Dr. J. W. Fisher, Medical Director of the Northwestern Mutual Life Insurance Company,

in his monograph "The Diagnostic Value of the Use of the Sphygmomanometer in Examinations for Life Insurance" says:

"The Northwestern Mutual Life Insurance Company, in August, 1907, required the local examiners of the company, in several of the larger cities, to furnish the company with the blood pressure readings of applicants examined by them where the applicant's insurable age was 40 to 60 years. (The company does not insure persons whose insurable age is over 60.) Gradually this requirement has been extended to all localities where it is possible to secure the blood pressure readings, so that at present the blood pressure is furnished in all localities in which the company does business where it is possible to induce the examiner to secure a Sphygmomanometer.

"The blood pressure is required, regardless of the amount applied for, in persons where the insurable age is between 40 and 60, and in any age where the medical examiner deems it advisable.

"In our home office examinations the blood pressure is taken at all ages. We, therefore, have a record of 420 accepted cases under the age of 40 with a blood pressure average of 125.20 millimeters. In addition, 26 applicants under the age of 40 were rejected, whose blood pressure was 150 millimeters or over.

"There were 12,647 persons insured with an average blood pressure, at ages 40 to 60, of 130.17 millimeters; at ages 40 to 44 of 128.26

millimeters; at ages 45 to 49, with an average of 130.51 millimeters; at ages of 50 to 54 an average of 131.98 millimeters; at ages of 55 to 60 an average of 134.46 millimeters. In all readings the pressure was adjusted as nearly as possible with a cuff of 12 centimeters in width.

"In 806 persons insured, whose weight exceeded the average by more than 20 per cent., 21 of these were under the age of 40, with an average pressure of 127.38 millimeters; 407 were insured at ages from 40 to 44, with an average pressure of 131.72, and 378 were insured at ages 45 to 49 with an average blood pressure of 134.60. In all cases where a number of blood pressure readings were taken, the average blood pressure was used in compiling the tables showing the average at the different ages.

"Of 2,668 insured, with a blood pressure of 140 to 149 millimeters was 81.85 expected deaths, and 31 actual deaths, a percentage of 37.87, which is slightly below the normal death rate of the Company on exposures of two years. It should be stated that the average exposure in all these cases was 2.09 years, covering a period from August, 1907, to January 1, 1911, and carried up to the anniversary of the policies to July 1, 1911.

"The mortality record of 525 persons insured with a blood pressure reading of 150 millimeters or over, was 22.19 expected and an actual of 12 deaths, which is about 35 per cent. in excess of the general average mortality of

the company covering the same period, and 18 per cent. higher than the average general mortality in the first five years of exposure covering the 20-year period of 1885-1905.

"The mortality record of 722 persons declined for insurance in whom the blood pressure average was 171.03 millimeters, 20.61 deaths expected, with 32 actual deaths, a percentage of 155.27, almost four times greater than the general average of the company.

"The records of this Company show that during the period from August, 1907, to January, 1911, the blood pressure of 13,789 applicants was furnished the company, that in 1,247 of these cases the blood pressure was 150 millimeters or over with a mortality of 102.80 per cent. of the table 33 of these were under 140 and the remainder were 40 to 60. The percentage of high tension was about 8 per cent. in the younger group and 9 per cent. in the older group."

Dr. Fisher concludes his paper by saying: "Notwithstanding the number of cases under observation at ages under 40 is comparatively small, in my judgment the results are sufficient to justify insurance companies requiring the use of the Sphygmomanometer in examinations for life insurance for applicants under the age of 40 at least until a large number of cases have been under observation for a sufficient length of time to enable us to definitely determine the diagnostic value of the Sphygmomanometer at the younger ages.

"No practitioner of medicine should be without a Sphygmomanometer. He has in this instrument a most valuable aid in diagnosis. The Sphygmomanometer is indispensable in life insurance examinations, and the time is not far distant when all progressive life insurance companies will require its use in all examinations of applicants for life insurance."

THE RELATION OF BLOOD PRESSURE TO DISEASES OF THE EYE

Cataract of the eye, and especially in people past the middle range of life, is always indicative of arterio sclerotic origin, and the blood pressure is generally high in these cases. Also in glaucoma of the eye we always find a correspondingly high blood pressure, and therefore it is strongly urged to determine the exact existing blood pressure of the patient before operating on either eye, ear or nose.

*The following paper has been very kindly presented to us for publication by Dr. Luther C. Peter, Philadelphia:

"Studies of arterial hypertension have developed the facts that it is a symptom of great importance, that it is a premonitory sign of chronic interstitial nephritis and general arterio sclerosis, and it increases after these diseases are well established, and that it is responsible for many symptoms that heretofore have been attributed to the vague term toxemia.

"Autotoxemia is a well recognized cause and an intensifier of an existing hypertension, and in this indirect way plays an important role in the evolution of the eye phenomena. It is not, however, a direct cause of these changes, but in common with other agencies acts through an increased tension.

"In a recent paper, Hoover calls attention to the inaccuracy of the results obtained by the

*Penn. Med. Journal, Athens, Pa., March, 1911.

average modern blood pressure instruments and methods. Admitting the timeliness of his criticism, until the laboratory workers can give us an instrument of more scientific accuracy, we have, in those at our command, a fairly reliable method of recording the variations in the pressure of the blood stream than the palpating finger can offer. Although the pressure taken over the radial artery in some instances may not coincide with that of the general blood stream, the reading of the radial pulse represents the peripheral circulation and will, therefore, be fairly representative of the eye. It furnishes records of comparison and thereby shows the progress either for better or for worse.

"Various phases of the effect of hypertension upon eye structures have been studied by Reber, Fox, de Schweinitz and others, and retinal hemorrhage has generally been attributed in diseases of the retina and choroid, to an increase of arterial tension.

"In a paper entitled 'Ophthalmic Studies in Chronic Interstitial Nephritis' I called attention to the more minute changes found in the eye in chronic interstitial nephritis due to this phenomena; to the fact that retinal edema and neuroretinitis were more frequently observed than the classic 'albuminuric retinitis,' and that a grave study of cases showed a more or less direct relation between the height of the tension and the severity of the symptoms observed, modifying influences being age, the degree of

arterio sclerosis, the duration of the high tension and the individual resisting powers.

"A study of the appended table of 104 cases confirms these observations in regard to chronic interstitial nephritis. Corroborative evidence may be found, first, in the morbid anatomy, which may be briefly summed up as the thickening of the media, edema, extravasation, hemorrhage and fatty degeneration. Second, in the fact that the eye changes are rare in the early history of parenchymatous nephritis, and the blood pressure is also low until the large white kidney gives place to the secondary contracted kidney, when the blood pressure is much increased and eye symptoms appear as in the case of primary contracted kidney; and third, in a comparative study of the same phenomena when it occurs in intracranial diseases. The neuroretinitis of nephritis and that of intracranial origin are so nearly alike as to be differentiated only by a grave study of the history of the case, its symptoms and its urinalysis.

"It is a difficult matter to find a clear case of chronic interstitial nephritis without a generalized arterio sclerosis, and vice versa, both due to a common cause and hypertension, as a rule, as a premonitory symptom. The two conditions are usually merged and that is particularly emphasized in the eye phenomena. In most instances one can say that arterio sclerotic changes predominate, or the retinal edema and neuroretinitis of nephritis is in greatest evidence.

"In either case there will be found varied degrees of increased blood pressure, and, other things being equal, the amount of retinal disease will be in proportion to the height and duration of the increased tension.

"Occasionally one will find early retinal diseases and a moderate increase of blood pressure, 150 to 170 millimeters in young adults, without other symptoms. Two cases of this type I have had under observation for over a year, and although examinations have been made at regular intervals, cast and albumin have only appeared in the last few specimens. These two isolated cases are numerically insignificant, but they tend to confirm the accepted view that increased blood pressure is one of the earliest premonitory signs of arterio sclerosis and chronic interstitial nephritis, and possibly acts as a causative factor, and second that arterial hypertension is the cause of early retinal and arterial changes as well as of the latter phenomena.

"Klatz, experimentally, has proven that hypertension alone may cause arterio sclerosis. After suspending rabbits with the head down for a definite length of time each day, he found at autopsy well-defined sclerosis of the aorta. He has, therefore, conclusively shown that this condition may be brought about without a toxic element being present. I regard this fact of importance because clinical evidences in these diseases point to a mechanical cause for the eye changes observed. It needs but a passing

reference to call attention to the difference between the minute and gross appearance of the neuroretinitis in question, and that of syphilis, a proliferative disease or a process of active inflammation and exudation.

"Another group of cases in which hypertension plays an active role is that of spasm or ataxia of the retinal artery or branch, causing temporary blindness usually hemianopic in type.

"Zentmayer, in a most excellent paper read before the Ophthalmologic Section of the American Medical Association in 1906, gave a resume of the literature on this subject and shared the belief of most writers that the majority of these cases were due to arterio sclerosis.

"In three cases which I have studied recently in adults from 20 to 26 years of age, the blood pressure was increased to 170 millimeters, and one case showed a low-grade neuro-retinitis, and two suffered only from a moderate venous engorgement and retinal haze. In each of the cases fields for form and color were contracted. Hemianopic blindness lasted for ten minutes to one-half hour, and both eyes were effected, but rarely at the same time. Headaches usually followed the blind attacks.

"It was not possible to examine any of the cases during the spasmodic periods. Without other signs of arterio sclerosis, and the patients otherwise apparently in average health, the presence of high blood pressure so early in life is significant. It is not unusual to find in aged people the same phenomena associated with

marked cardiac diseases and arterio sclerosis, and in a few of these cases embolism has been the cause, as borne out by the subsequent history of cases. Others and probably most of this group never give any evidence of embolism.

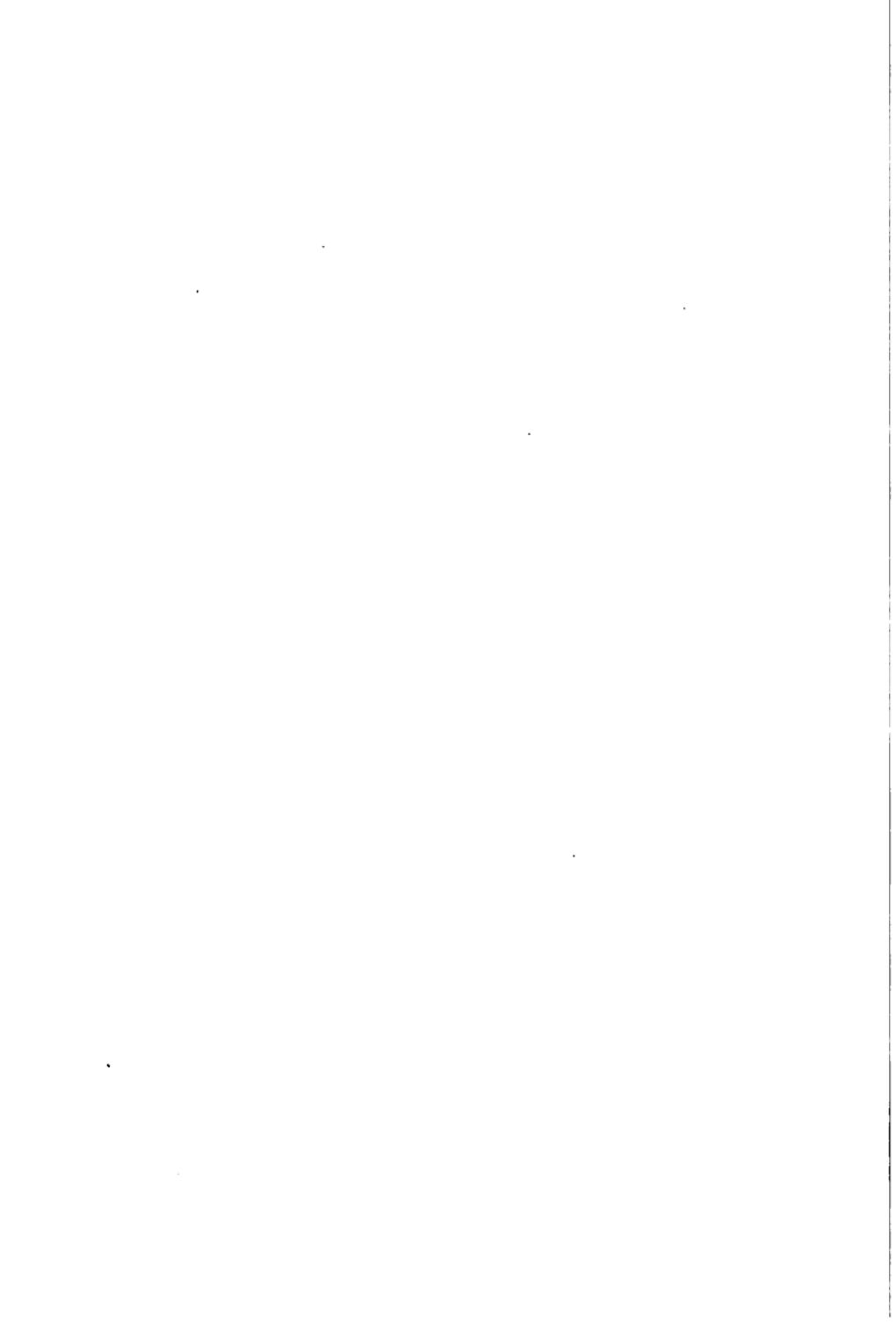
"The analogue of this condition is frequently found in the brains of these people in the form of hemiplegic and monoplegic paresthesias and anesthesias, and accompanying mental changes, the blood pressure usually being very high. It would be difficult to say just how the increased blood pressure can bring about a spasm of the individual artery. We know that the elastic and muscular part of the artery is in the media, and it probably is the result of the over-stimulation of this structure undergoing hypertrophic and degenerative changes in readjusting itself to the increased resistance demanded by high blood pressure.

"In passing, I want to call attention to an unfortunate group of cases which arterial hypertension may help to explain, namely, intraocular hemorrhage after cataract extraction.

"I have not had an opportunity of making blood pressure studies in any of these unfortunate cases, but a large number of cataract extractions are made on subjects who are victims of senile sclerosis, general arterio sclerosis and general interstitial nephritis, and most of them have a pathological increase in blood pressure.

"Few ophthalmologists regard sclerosed

arteries as a contraindication to cataract operations, but it is very probable that routine blood pressure studies in senile cataract patients might throw light on this interesting subject of hemorrhage, and an appropriate treatment or preparation of individual cases might reduce this accident to a minimum."



RELATION OF ARTERIAL HYPERTENSION TO SUBCONJUNCTIVAL HEMORRHAGE

An analysis of 100 cases of retinal hemorrhage reported by Fox and Batroff show 17 cases of subconjunctival hemorrhage with an average blood pressure of 167 millimeters. My list of cases with these conditions is small, but all had an increase of pressure. It is not unusual to find subconjunctival hemorrhage in cases of normal and subnormal pressure in the blood stream, but the presence of this form of hemorrhage without apparent cause should direct attention to blood pressure and conditions which are apt to bring about this increase. They should serve as a warning of the possible presence or development of more serious eye conditions.

In the study of glaucoma clinical material is not as abundant and the study is necessarily slower. The question of coincidence must be eliminated because many cases occur in subjects who have general arterio sclerosis. In the limited number of cases which I have studied, I have failed to find one instance of glaucoma (buphthalmus alone excepted) in which blood pressure was not increased irrespective of age or type. The pressure was usually taken over both radials, and no constant increase was noted on the side of the affected eye. So uniform have been the findings in the study thus far that I feel safe in concluding that increased blood pres-

sure is a factor in the production of glaucoma, and further study along these lines may show a closer relation than we feel justified in assuming at this time.

The 104 cases in the table are taken from my private case book and that of the Willis Hospital in the service of Dr. Charles A. Oliver, and only cases carefully studied ophthalmologically, clinically and in the laboratory are included in this report. The blood pressure in each instance was taken over the radial pulse with the patient seated and the arm elevated to the level of the heart. Only systolic pressures are recorded. For purposes of comparison 9 cases of sphyilitic neuro-retinitis are included in the report, showing an average pressure of 132 millimeters, and three cases of chronic parenchymatous nephritis with an average pressure of 132 millimeters. The average pressure in 20 cases of retinitis was 165 millimeters; in 59 cases of neuro-retinitis it was 185 millimeters; in 3 cases of albuminuric retinitis 190 millimeters; in 6 cases of hemorrhagic retinitis 205 millimeters, and in 3 cases of papillitis 225 millimeters.

Thirty-three of the 94 kidney cases occurred in men and 61 in women. The higher pressures were observed relatively much more frequently in men than in women.

Conclusions that may be drawn from this report are:

1. Arterial hypertension is the chief cause of the eye-ground phenomena observed in

chronic interstitial nephritis and arterio sclerosis.

2. Similar vascular changes, associated with high blood pressure, may be observed at times before these diseases are diagnosed by other clinical symptoms.

3. It frequently acts as a cause for subconjunctival hemorrhage and is so closely associated with glaucoma that it may be regarded as an active factor in the development of the disease.

4. It probably will help to explain the phenomena of intraocular hemorrhage after cataract extraction.

5. In order to prevent and to treat rationally the more serious eye conditions, routine blood pressure studies should be made in all cases of intraocular diseases not traumatic in origin.

Dr. Peter, closing, says:

"I simply want to add that the same patient will show marked variations in blood pressure at different times. He will come to the office one day with a pressure of 200 to 225 millimeters, and another day with 150 millimeters.

"Many conditions influence blood pressure. I do not wish to be misunderstood in regard to the role that toxemia plays, but I feel that it intensifies the blood pressure and that increased blood pressure is the direct cause of these changes."

Case	Age	Sex	Eye Condition	Systolic Blood Pressure	General Conditions
1*	43	F.	Neuro-retinitis.	145 mm.	Syphilis.
2*	36	F.	"	125 mm.	"
3*	50	M.	"	125 mm.	"
4*	50	M.	"	140 mm.	"
5*	45	M.	"	120 mm.	"
6*	46	F.	"	140 mm.	"
7*	29	F.	"	120 mm.	"
8*	37	M.	"	140 mm.	"
9*	19	F.	Neuro-retinitis and ptosis O. D.	125 mm.	"
10	35	F.	Negative.	122 mm.	Chronic parenchymatous nephritis.
11	42	F.	"	130 mm.	"
12	45	M.	Thrombosis of retinal vein.	145 mm.	"
13	57	F.	Retinitis.	140 mm.	Chronic interstitial nephritis.
14*	45	M.	"	140 mm.	"
15	58	F.	"	145 mm.	"
16*	50	M.	"	150 mm.	"
17*	38	F.	"	160 mm.	"
18	68	F.	"	160 mm.	"
19	49	F.	"	160 mm.	"
20	65	F.	"	165 mm.	"
21	20	M.	"	165 mm.	"
22	62	F.	"	170 mm.	"
23	60	F.	"	170 mm.	"
24	50	F.	"	170 mm.	"
25*	55	F.	"	170 mm.	"
26	62	F.	"	170 mm.	"
27	67	F.	"	170 mm.	"
28*	45	M.	"	170 mm.	"
29	26	F.	"	170 mm.	"
30	43	M.	"	175 mm.	"
31	66	F.	"	180 mm.	"
32	50	F.	"	180 mm.	"
33	67	F.	"	180 mm.	"
34	43	F.	Neuro-retinitis.	145 mm.	"
35*	46	F.	"	150 mm.	"
36*	55	F.	"	150 mm.	"
37*	50	M.	"	150 mm.	"
38*	52	M.	"	155 mm.	"
39*	35	F.	"	155 mm.	"
40	50	F.	"	155 mm.	"
41*	44	M.	"	155 mm.	"
42*	52	F.	"	155 mm.	"

Case	Age	Sex	Eye Condition	Systolic Blood Pressure	General Conditions
43	56	F.	Neuro-retinitis.	160 mm.	Chronic interstitial nephritis.
44	56	M.	Neuro-retinitis and subconjunctival hemorrhage.	160 mm.	"
45	67	F.	Neuro-retinitis.	160 mm.	"
46*	64	F.	"	160 mm.	"
47*	49	F.	"	160 mm.	"
48	50	M.	"	165 mm.	"
49*	45	F.	"	165 mm.	"
50	53	F.	"	170 mm.	"
51	26	F.	"	170 mm.	"
52*	50	F.	"	170 mm.	"
53*	37	F.	"	170 mm.	"
54*	57	M.	"	170 mm.	"
55*	40	F.	"	170 mm.	"
56*	49	F.	"	170 mm.	"
57*	45	F.	"	170 mm.	"
58	58	F.	"	170 mm.	"
59	21	F.	"	175 mm.	"
60	26	F.	"	175 mm.	Chronic Interstitial nephritis following kidney of pregnancy.
61	28	F.	"	175 mm.	Chronic Interstitial nephritis following kidney of pregnancy.
62	68	F.	"	180 mm.	Chronic interstitial nephritis.
63	70	F.	"	180 mm.	"
64	57	F.	"	180 mm.	"
65*	75	M.	Neuro-retinitis and subconjunctival hemorrhage.	180 mm.	"
66	65	M.	Neuro-retinitis.	180 mm.	General Arteriosclerosis.
67*	49	M.	"	180 mm.	Chronic interstitial nephritis.
68	70	M.	"	180 mm.	"
69*	70	F.	"	180 mm.	"
70	48	M.	"	180 mm.	"
71	65	F.	"	180 mm.	"
72	62	M.	"	180 mm.	"
73*	52	F.	"	185 mm.	"
74	55	F.	"	190 mm.	"

Case	Age	Sex	Eye Condition	Systolic Blood Pressure	General Conditions
75	62	M.	Neuro-retinitis.	190 mm.	Chronic interstitial nephritis.
76*	76	M.	"	200 mm.	"
77*	53	F.	"	200 mm.	"
78*	59	F.	"	205 mm.	"
79*	60	M.	"	210 mm.	"
80*	54	M.	"	210 mm.	"
81*	66	F.	"	210 mm.	"
82	58	F.	"	215 mm.	"
83	54	F.	"	220 mm.	"
84*	60	M.	"	220 mm.	"
85*	63	F.	"	220 mm.	Chronic interstitial nephritis and diabetes.
86*	28	F.	"	225 mm.	Chronic interstitial nephritis following kidney of pregnancy.
87*	53	F.	"	230 mm.	Chronic interstitial nephritis.
88*	71	F.	"	230 mm.	"
89*	45	M.	"	235 mm.	"
90*	62	F.	"	250 mm.	"
91*			"	260 mm.	"
92	61	M.	"	260 mm.	"
93*	55	F.	Hemorrhagic retinitis.	165 mm.	"
94*	57	F.	"	165 mm.	"
95	68	M.	"	200 mm.	"
96*	52	M.	"	210 mm.	"
97*	67	F.	"	220 mm.	"
98*	63	F.	"	260 mm.	"
99*	66	M.	Albumimuric retinitis.	140 mm.	"
100*	55	M.	"	191 mm.	"
101*	53	M.	"	240 mm.	"
102	52	M.	Papillitis.	220 mm.	"
103*	54	M.	"	225 mm.	"
104*	66	M.	"	225 mm.	"

*Record of case in clinic of Dr. Charles A. Oliver,
Wills Hospital.

BLOOD PRESSURE IN SURGERY

The use of the Sphygmomanometer in surgery is very clearly defined, for it is of the utmost value to the anesthetist as well as to the surgeon.

Previous to operating, a series of observations should be made to determine the patient's normal pressure. During the operation the pressure should be taken every four or five minutes, and any decided change in the pressure would show the anesthetist just what to do without having to wait for any other clinical indications to become manifest. He has in the use of the instrument complete control of the anesthesia at all times.

After the operation, the pressure should be taken again and carefully recorded on blood pressure charts. This should now be done every four hours until such time as the patient is entirely out of danger.

Any sudden drop in pressure would signify danger ahead and forewarn the one in charge of the case.

The instrument will determine well in advance of any other clinical observation the necessity of stimulation.

Dr. H. K. Thoms of New London, Conn., in an article on the use of the Sphygmomanometer during surgical operations, says as follows:

"Although the clinical use of the Sphygmomanometer is well established, its use in con-

nnection with surgical procedure is in no way as general. That the use of the instrument during operations is not more universal is singular, especially when its advantages are considered.

"Where the determination of blood pressure is used in this connection, the usual procedure is to record the pressure just before and immediately after the operation. There is no doubt that in this way you have a valuable aid to the diagnosis of surgical shock, but we have no means of knowing how long such shock, if present, has supervened.

"It is the purpose of this paper to emphasize the importance of requiring blood pressure, together with the pulse and respiration, at five minute intervals. By this means we not only have the indication of shock when present, but an indication of the exact time when such shock has become manifest.

"I have used this procedure in my work at the Memorial Hospital with Dr. H. M. Lee for the past six months, and the results have been so convincing that it has become routine in major operations.

"For this purpose we have used a Sphygmomanometer of the dial type, namely, the "Tycos" instrument. This has been employed because of its simplicity, and more especially its small size.

"The determination and charting are put in charge of one of the surgical nurses, who does nothing else during the operation, thus leaving the anesthetist wholly to the anesthesia.

"In operations below the thorax, the pulse

and pressure are taken at the arm or wrist. In work upon the head, neck or thorax the determinations are readily made at the foot of the patient, placing the apparatus around the ankle and using the dorsalis pedis artery for palpation.

"Of course, there are variations in blood pressure during the operation, which we might call more or less normal, and these must be duly considered in the interpretation of the readings.

"Any cutting operation causes an initial rise. Also, when any of the large trunk nerves are irritated, we may expect a greater reflex rise. Opening the peritoneal cavity is usually accompanied by a sharp rise, followed by a more or less fall of blood pressure, depending upon the amount of exposure and manipulation of the viscera. Even large amounts of ether seldom produce any marked fall of blood pressure.

"In one case in an operation for tumor of the broad ligament, we had the usual initial rise, accompanied by the fall due to the manipulation and removal of the tumor mass. Following this is a gradual rise until the finish of the operation.

"This is a type of case that is spoken of as 'reacting well' at operation.

"The second case is that of a patient with a malignant disease, requiring complete hysterectomy at operation. The initial rise and fall in this case is not succeeded by the gradual rise as before. We find instead that the pressure hovers between 80 and 90, and we may safely

say at this point that the surgical shock has become a factor to be taken into consideration.

"Subsequently, we see a gradual fall to 60 millimeters, and there is no doubt now that the surgical shock has become manifest and must be combated. At this point 600 cc. of normal saline with adrenalin was given intravenously, and the sharp rise shows the influence of such a procedure.

"It is perfectly obvious that the greatest value of the determination of blood pressure at frequent intervals is from the standpoint of the anesthetist. It is his duty not only to give satisfactory narcosis, but he must at all times be cognizant of the exact condition of the patient. So much depends in the personal element on his part, that any procedure by which this can be more or less eliminated must certainly be welcome. Not only has he a means of knowing the condition of the patient in regard to the surgical shock, but we can also by comparison with previous readings determine, to a great extent, the amount of shock if present.

"The treatment of shock is more or less successful, for by this means we can institute treatment at a time when it can be said to be almost prophylactic. Such measures as the intravenous injection of saline can be instituted at the beginning of the shock by the assistant, and no delay in operation is made.

"It is our custom also to chart the steps of the operation at the proper time, and these charts form a valuable addition to the history and clinical charts."

BLOOD PRESSURE IN TUBERCULOSIS

In all well-defined cases of tuberculosis (not complicated by kidney troubles) the systolic pressure will be low and the diastolic pressure high, showing a very much weakened heart impulse. As the ravages of the disease increase, so will the blood pressure decrease, and the potential difference or pulse pressure will become smaller; but if the treatment is having a beneficial effect on the disease an increase of the potential difference to nearer normal shows conclusively the patient's condition.

It is well to bear in mind that upon examining a patient with a low systolic and a high diastolic reading (if other wasting diseases can be eliminated), even although other positive clinical indications are not present, to carefully consider a predisposed condition, for this is very often the case, and by keeping the patient under observation you will find that other clinical symptoms will soon become manifest.

Lauder Brunton says that he almost unconsciously associates a low blood pressure with a predisposed tubercular condition.

Haven Emerson, in a very able article on "Blood Pressure in Tuberculosis" in the April, 1911, issue of the Archives of Internal Medicine, says:

"The positive opinions of the German writers, that physical or other definite signs of tuberculosis infection always precede any characteristic alteration of the blood pressure,

and the enthusiastic convictions of the French writers that they often make a correct diagnosis on finding characteristic hypotension before physical signs of the disease are observable, led me to make clinical tests to see if any help could be had from the Sphygmomanometer in the early diagnosis of pulmonary tuberculosis.

"If then we find either stationary or falling blood pressure, or a marked increase in the heart-rate on a change from the horizontal to the erect position, we may properly assume that there is a lack of proper tone, or vasoconstrictor control. Such a condition is not uncommon in under-nourished, fatigued people of sedentary habits, and in those who have been for some weeks bedridden or have recently recovered from an infectious disease. It is rare to find a person in good health who will exhibit any but a slight increase in heart-rate, or fall in blood pressure, or rise in blood pressure, with a marked increase in the frequency of the pulse in this test."

Renaud says: "Recognition of the symptom of hypotension is of incontestable value in doubtful cases of pulmonary tuberculosis, even before stethoscopic signs in pleurisy with effusion, in making a differential diagnosis and in atrophic cirrhosis of the liver with ascites to determine the origin of the fluid."

Teisser finds: "Hypotension a constant and precocious sign before local or general symptoms, and noted in those with hereditary predisposition and in those with latent tuberculous lymphnodes."

"A most important and valuable sign indicating a tuberculizable field or an actual infection, and not a pathognomonic sign.

"Carefully made pressure observations, well controlled, taken with general and physical signs, give valuable diagnostic and prognostic results in tuberculosis."

Standgaard finds: "Hypotension a valuable aid in diagnosis suggesting tuberculosis in general or an active process in particular. The pressure is low in proportion to the stage of the disease, and hypotension is a valuable aid in diagnosis."

Reitter's conclusion is: "Hypotension shares the fate of so many other symptoms of disease which are not always found in every case, but when they do occur are of marked value in differential diagnosis—e. g., if hypotension occurs in the case of nephritis or renal lithiasis, there is probably renal tuberculosis. Hypotension should make us suspect tuberculosis even if the lesion found is a renal one."

Dr. Haven Emerson further says: "*Any case of hypotension should put us on our guard at once. If it persists, and no other cause is found to explain it, such a hypotension should probably be treated on much the same hygienic principles as suspected early tuberculosis.*"

"Hypotension is found in almost all cases of moderately advanced tuberculosis, or in the early cases in which the toxemia is marked, except when arterio sclerosis, the so-called arthritic or gouty diathesis, chronic nephritis

or diabetes complicate the tuberculosis and bring about a normal pressure or hypertension.

"Occasionally the period just preceding an hemoptysis, or during an hemoptysis, may show hypertension in a patient whose usual condition is that of hypotension. Hypotension has been found by so many observers in our early doubtful suspected cases, with or before physical signs of the disease in the lungs, and is considered by competent clinicians so useful a differential between various conditions and tuberculosis that it should be sought for as carefully as is the custom at present to search for pulmonary signs.

"Hypotension, when found persistently in individuals or families or classes living under certain unhygienic conditions, should put us on our guard against at least a predisposition to tuberculosis. Most unhygienic conditions, over-work, under-nourishment and insufficient air are of themselves causes of the diminished resistance, and it seems likely that a failure of normal cardio-vascular response to exercise or change of position may be found to indicate this stage of susceptibility, especially to tuberculous infection.

"Continuation of hypotension seems never to accompany improvement. Prognosis can as safely be based on the alteration of blood pressure as on changes in the pulse or temperature.

"The treatment of tuberculosis, in all its stages, should take into consideration the need of assisting in every way the return to normal

pressure, first by relieving the relaxed vessels of the load put on them during the vertical position or exercise, and later by assisting the heart by abundant nutrition, moderate exercise and the stimulating effect on the cardiac and vascular tone by cold fresh air to meet the extra work put on it by the loss of vascular tone.

"Thus will the heart be able to obtain its normal bulk and strength, or even to gain from the atrophy, or small size of the early disease, to a normal size, so that the brain, kidneys, lungs and body at large may be properly nourished until the disease is arrested and the toxic products of the tubercle bacillus are no longer distributed from the site of the lesion.

"Dyscrasia is generally a factor in advanced stages of tuberculosis."

BLOOD PRESSURE IN TYPHOID OR ENTERIC FEVER

Typhoid Fever shows pretty nearly always a low blood pressure except in one instance, i. e., when complicated by pneumonia.

From the end of the first week of the disease the pressure begins to fall, and will generally continue to fall until about the end of the fourth week, even in some cases going as low as 90 millimeters systolic pressure, with a high diastolic. After the fourth week the pressure will begin to rise gradually.

A decidedly marked rise in pressure always attends a perforation.

By keeping close blood pressure records one can differentiate between the collapse from hemorrhage and intestinal perforation. Where peritonitis exists, the fall in pressure is extreme and the condition fraught with danger.

It is always well to keep a careful watch of the arterial conditions after Typhoid Fever, as quite often arterio sclerotic conditions will be found as the result of the disease.

*Joseph H. Barach, M. D., of Pittsburg, in an article on "Blood Pressure Studies in Typhoid Fever," says as follows:

"Let us consider of what value has been the study of blood pressure in typhoid fever:

1. "It has shown us that the blood pressure falls from the normal after the patient has taken

*Penn. Medical Journal, July, 1907.

to bed and stays down until convalescence is established, and then returns toward normal.

2. "That typhoid fever is a disease with a blood pressure below 100.

3. "That the blood pressure is governed by factors of its own and bears no constant relation to pulse rate or temperature.

4. "That in diagnosis blood pressure may be of value in differentiating this disease from others after we know the behaviour of other diseases in this respect. In the diagnosis of the complications it has a value.

5. "That in prognosis the blood pressure chart is of value. A steadily falling pressure means great danger. As long as the blood pressure keeps up to a reasonable level, we may feel that there is reserve power to work with.

6. "That in the treatment of the disease the study of blood pressure will probably be found of the greatest actual value. It may teach us that the way to combat circulatory failure in typhoid fever is to increase peripheral resistance, or when to direct our efforts at the heart, and when at the blood vessels, and when it is well to increase and when it is well to diminish the amount of fluid in the vessels."

Report of one case of Typhoid Fever by Dr. David Baldwin Jewett, attendant physician, Rochester Homeopathic Hospital.

"R. H. Hosp., No. 8649, was admitted to the hospital September 5th, on what we know to be the twelfth day of the disease.

"On September 6th, a Widal and blood

examination by Dr. W. C. Daly showed a positive Widal reaction. White blood cells 5,000, polynuclears 60 per cent, lymphocytes 40 per cent (approximate).

"During the seven days the patient was only moderately ill, the temperature ranging from 102 to 103° F., the pulse from 100 to 105.

"There is no distention; one or two stools a day; no decided nervous symptoms. The systolic pressure recorded daily was about 90 to 95 millimeters.

"On September 12th, the pulse became more rapid, reaching 140. The blood pressure fell to 65 millimeters, and the temperature fell to 101. During the day, she had two stools containing blood. She was given adrenalin 10 m. hypo. every three hours, and at 3.30 the pulse was 108 and her blood pressure had risen to 85 millimeters. That evening the patient had a temperature of 102.3, and slept well until 3 A. M. on September 14th, when she became nervous, and shortly before four had a griping pain in the abdomen. Her temperature dropped to 99 4-5, pulse 118, respiration 30. The pain continued, only more mild at varying intervals from 5 to 30 minutes.

"Her condition was about the same until about 10 A. M., when I first saw the patient. At that time her temperature was 104 4-5, pulse 128, respiration 34. At 9 A. M., the blood pressure had been taken by the resident, Dr. Hazard, and was 90 millimeters; at 10 A. M., 100 millimeters; at 12, 110 millimeters.

"The pains, when I saw her, were intermittent at intervals of 5 to 10 minutes. The abdomen was not distended and there was no loss of liver dullness. There was a generalized tenderness of the abdomen, and increased resistance to pressure, but not rigidity.

"A blood examination by Dr. Daly showed white blood corpuscles 6,900, polynuclears 98.5, lymphocytes 10.5, no eosinophiles. A diagnosis of probable perforation was made and an operation was advised, which was performed at 2 P. M. by Dr. S. R. Snow.

"If the perforation took place about 4, the diagnosis was made when first seen six hours afterward, and she was operated on ten hours after same.

"For the ensuing 48 hours, she was kept under the influence of morphia, with the idea of preventing peristaltic action.

"The stitches were removed on the eighth day, and it can be fairly stated that the patient had recovered from the operation. She, however, had a severe relapse lasting about four weeks, and then during the third week of convalescence had a pyelitis, from which the patient is only now recovering.

"With the beginning of suspicious symptoms our attention must be increased, temperature, pulse and respiration being recorded hourly, the blood pressure taken hourly, and a leucocyte count made and repeated if desired, and in this way we may diagnose the perforation instead of the ensuing peritonitis.

"Blood pressure findings are important, but we must have taken daily readings beforehand in order to make them useful. In such cases as typhoid, it has been our custom to make daily observations, and the average of 12 to 15 cases has been from 90 to 100 millimeters. In this case the pressure varied from 85 to 95 millimeters. Five hours after the perforation, the pressure was 95; six hours 100; seven hours 110."

BLOOD PRESSURE IN PNEUMONIA

Uniform results of blood pressure readings in pneumonia have been hard to obtain, but the following conditions seem to prevail in the majority of cases.

In the first day or two of the disease the blood pressure is generally a little high; in other words, a slight hypertension exists, which is followed on the third or fourth day by a rapidly falling pressure, which, in severe cases, has been known to drop to 80 or 90 millimeters. In fatal cases a rapid drop has been noted, with dilatation of the heart.

It is generally conceded that up to the time of the crisis in both broncho and lobar pneumonia blood pressure will run about 100 to 105 millimeters, but after the crisis and as convalescence begins, the pressure will rapidly come back to a normal condition.

In mild cases the blood pressure changes but little from the normal condition.

The results of blood pressure readings in pneumonia have been, as stated above, varying, and Janeway's remark on the cause, seems to be very true, i. e.:

"When one pictures the possible causes for variation in lobar pneumonia, the difference in individual reaction to the toxemia, and in extent of lung tissue involved, the motor restlessness of some patients, the urgent dyspnea of others, and the great likelihood of an asphyxial rise of pressure where cyanosis is extreme, there is

little wonder at the somewhat discordant results."

A pressure that is distinctly below normal is generally a bad sign, and often points to a fatal termination. Gibson's rule in pneumonia is undoubtedly a valuable and safe one to follow, i. e.:

"When the arterial pressure expressed in millimeters of mercury does not fall below the pulse rate expressed in beats per minute, the fact may be taken as an excellent augury, while the converse is equally true, i. e., when the pulse rate per minute is higher than the pressure of the millimeters of mercury, the equilibrium of the circulation is seriously disturbed."

The use of the Sphygmomanometer in pneumonia is strongly indicated, both from a diagnostic and prognostic standpoint, as it shows the effect and distribution of the treatment.

BLOOD PRESSURE IN ARTERIO SCLEROSIS

A disease of the arterial system characterized by chronic degenerative changes in the walls of the arteries, causing a persistent and very high blood pressure, which in many cases makes distinct changes in organs and eventually sets up a vascular dyscrasia in which all organs are involved.

Bergman has found some arteries effected more than others:

Ulnar Artery	94%
Arteries of the Brain.....	87%
Subclavian	88%
Radial	86%
Popliteal	79%
Femoral	69%
Ascending Aorta	67%
External Iliac	58%
Axillary	71%
Tibialis Antica	93%
Internal Carotid	87%
Splenic	82%
External Carotid	78%
Common Carotid	68%
Abdominal Aorta	64%
Brachial	55%

In a collection of cases by Max Herz of Vienna, he gives as causes for this disease—Age in 455 cases, alcohol in 451, syphilis in 406, diseases of metabolism in 397, physical labor in 354, tobacco in 339, hereditary in 267, food and

drink in general 103, infectious diseases in 104, tea and coffee in 61, and temperature changes in 53.

The systolic pressure is always very much higher than the diastolic, showing an excessive pulse pressure, and that a continued and persistent hypertension always exists.

The writer made one blood pressure reading at the Cook County Hospital in Chicago, on a negro 61 years old, partially senile, where the systolic pressure was 254 and the diastolic 100.

BLOOD PRESSURE IN ASPHYXIA

“If an animal be deprived of oxygen, phenomena ensue which produce a picture we call Asphyxia.

“If the deprivation be sudden, as on tying off the trachea, death occurs inside of five minutes and is preceded by convulsions. Where suffocation is more gradual, as in a closed chamber, convulsions do not appear and life is more prolonged.

“In addition to the motor and respiratory manifestations with dyspnea, however, there is a striking effect upon the vasomotor and vagus centers.

“In the first stage, during which the respiratory center is stimulated and breathing is rapid and deep, the vasomotor center in the medulla is also thrown into action and a marked rise in blood pressure occurs, which is accompanied by increasing slowness of the pulse and simultaneous activity of the vagus center.

“In the latter stages, as the irritability of the respiratory centers becomes exhausted, the other bulbar centers likewise fail. Then the spinal vasomotor centers begin to act and the blood pressure is maintained at a high level, with increasing heart rate, and spasmodic, ineffectual respiratory action, only to fall during the last seconds of life when the spinal centers have become utterly exhausted.

“An extreme rise of blood pressure caused by asphyxia, and in a lesser degree by slighter

grades of deficient oxygenation of the blood, is of distinct clinical import, as in the study of arterial pressure in cardiac and lung conditions, laryngeal diphtheria, etc."

—Janeway's "Clinical Study of Blood Pressure."

BLOOD PRESSURE IN CHRONIC INTERSTITIAL NEPHRITIS

Chronic Interstitial Nephritis is caused by inflammation of the kidneys in connection with an overgrowth of connective tissue, urine of low specific gravity, arterio sclerosis, the albumin being light and often absent, while the vascular changes are sclerotic and the contracted kidney is the result.

In chronic interstitial nephritis the blood pressure is very high and sustained, the systolic pressure being anywhere from 175 to 250 millimeters, with a low diastolic pressure, showing a long range of potential difference or pulse pressure. The reduction of pulse pressure is important, as it shows the effect of the treatment and renders the prognosis much better; while, on the other hand, an increased pulse pressure would be quite the contrary.

While the prognosis in this disease is always hopeless, it is still possible, under proper management, diet, manner of living, self-denial, etc., to prolong life for years.

Osler says: "Of all indications, that offered by the pulse is most important. If there is any doubt regarding the character of the pulse the blood pressure may be very easily and accurately determined by the Sphygmomanometer."

Janeway places much dependence in the use of this instrument. He says: "Given a systolic pressure of over 200 millimeters, the diagnosis of contracted kidney must be disproved by repeated examinations before it is abandoned."

—Janeway's "Clinical Study of Blood Pressure."

BLOOD PRESSURE IN NEURASTHENIA

Partly due to poor nutrition, functional over-exertion, inherited by some and acquired by predisposed individuals. It is marked by nervous exhaustion, slight exertion causing prostration and bringing on the distressing symptoms from which the subject suffers. Tinnitus, or noises in the head, is sometimes present.

In true Neurasthenia the blood pressure will be low, i. e., a low systolic and a high diastolic, caused by exhaustion of the nerve centers. In a large majority of the cases, systolic pressure will fall as low as 95 or 100, with a high diastolic pressure, showing a very short range of potential difference or pulse pressure, therefore the heart impulse being very much weakened.

By the use of the Sphygmomanometer one can definitely determine the patient's condition on each examination.

BLOOD PRESSURE IN INCREASED INTRACRANIAL TENSION

In this condition you will undoubtedly always find the highest blood pressure recorded in disease; meningitis, apoplexy, cerebral thrombosis, fracture of the skull, intracranial hemorrhage, rapidly growing brain tumors and some cases of uraemia.

Hirschfelder ("Diseases of the Heart and Aorta") says: "Maximal Blood Pressure may rise to 300 or 400 millimeters, minimal to 160 or over, pulse rate low, 60 or under."

Cushing has shown that when the intracranial tension rises above the blood pressure, anaemia of the vasmotor center brings about a tremendous vasoconstriction and action of the augmentor fibers in increasing the strength of the heart beat. The blood pressure rises in successive stages (Traube-Hering waves) until the mean pressure exceeds the intracranial pressure. The rise of blood pressure expresses the need of the brain for blood to counteract a vasoconstriction with nitrites or other vasoconstrictors, or by venesection only increases the task of the heart.

The only medical treatment which aids it at all is administration of atropine to paralyze the vagi, quicken the heart and permit the pressure to rise more readily. Lumbar puncture helps somewhat by removing the excess of intracranial fluid.

If this does not suffice, Cushing advises

surgical interference in many cases,—a flap of the skull being lifted temporarily in order to relieve the intracranial tension and to allow the blood pressure to fall. This procedure is almost devoid of danger in the hands of a surgeon whose asepsis is perfect, but very dangerous if it is imperfect, as this point alone will often decide the advisability or inadvisability of the operation.

BLOOD PRESSURE IN ANESTHESIA

The following very interesting article, with charts, was kindly given the writer for publication by Dr. E. I. McKesson of Toledo, O., who says as follows:

"Probably the most exact and reliable source of information concerning the condition of the heart and circulation during anesthesia is obtained by taking the blood pressure. The estimation of blood pressure, even by those of wide experience, cannot be taken by palpating the radial artery without great error, and if frequent determinations for comparisons are to be of value they must be quite accurately made.

"When the patient is to be anesthetized the determination of blood pressure will greatly assist in the selection of the drug or agent which is least liable to produce immediate or remote complications. For example, a drug which would increase arterial tension would not be used for a patient with a high blood pressure and arterial sclerosis.

"After anesthesia has been established, repeated determinations of the blood pressure, together with pulse and respiration rate, will give the anesthetist and surgeon the most valuable information concerning the patient's condition during the operation. Large variations in blood pressure, such as 20 to 30 millimeters, have a definite cause which should be immediately located and appropriate measures taken for its elimination.

NO. _____

Anesthetist's Chart

NITROUS OXIDE AND OXYGEN

AGE 35

SEX MALE

WT. 160

PHYSICAL APPEARANCE

LUNGS

HEART

URINE

OPERATION

PREANESTHETIC HYPNOTIC

Fairly good (alcoholic)

COMPLEXION

or

negative

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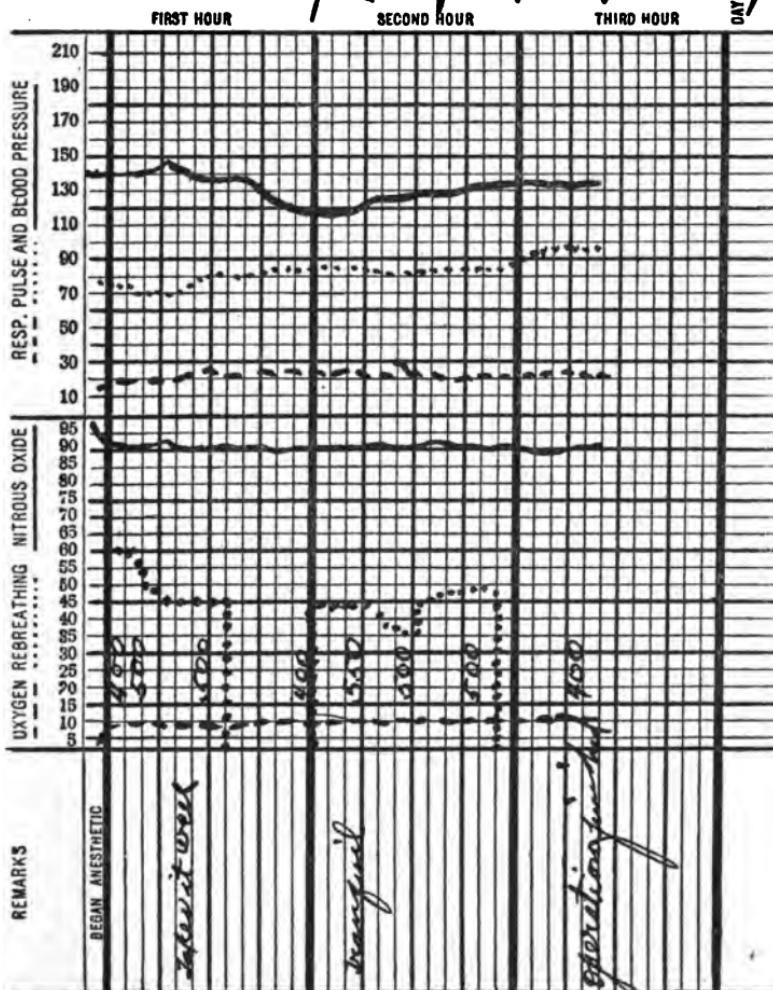
Anesthetist's Chart
NITROUS OXIDE AND OXYGEN

AGE 52
SEX F
WT. 160

PHYSICAL APPEARANCE Good COMPLEXION Br.
LUNGS negative
HEART " "

URINE Ball stone, Urinary & vaginal repair TIME BEGUN 10:30

OPERATION Ball stone, Urinary & vaginal repair TIME OF COMIS. 1:45 P.M.
PREANESTHETIC HYPNOTIC Magn. 6 Atrop. 1/50



RECOVERY OF CONSCIOUSNESS - MINUTES 15
POST OPERATIVE VOMITING none

"The most common and serious difficulty associated with the lowering of blood pressure during anesthesia is shock, the early recognition of which cannot be made with the palpating finger, but requires a more accurate recording apparatus which will permit of definite comparisons. Such information is most valuable, because in the early stages only can treatment result in prompt recovery. The warning thus obtained upon the lowering of the blood pressure will assist the surgeon in planning his work, and the anesthetist in correcting his administrations, so that the best possible results may be accomplished with the least risk.

"The accompanying charts illustrate the value of the use of the Sphygmomanometer in anesthesia.

"The one illustrates a frequent blood pressure curve in an ether anesthesia, and the other shows the effects of beginning shock on blood pressure, pulse, respiration, and also shows how a further development of shock may be remedied under gas and oxygen anesthesia."

BLOOD PRESSURE IN OBSTETRICS

By the use of the Sphygmomanometer in pregnancy, toxemia of the kidneys can be determined fully six weeks before the presence of albumin is noticed in the urine, by rise in blood pressure. This is infallible, and has been proven beyond any shadow of a doubt by the leading obstetricians and maternity hospitals throughout the country.

The use of this instrument in this branch of medicine cannot be too strongly emphasized, as the physician can at all times tell exactly his patient's condition and the condition of the kidneys, and he can always tell exactly whether he is overcoming the condition or not.

In pregnancy there is absolutely no rise in pressure caused by the pregnant condition itself, as that condition is a natural one and is thoroughly compensated for by nature, and any rise in pressure should be regarded as highly suspicious and thoroughly investigated.

It seems to be the consensus of opinion among the leading obstetricians that it is highly dangerous to carry a patient through the 280th day with a pressure of over 145 millimeters, for Eclampsia is almost inevitable with a pressure running that high. In normal pregnancy the pressure will run even throughout the 280 days, but as the expulsive pains begin the pressure rises in jumps, and then falls until the next pain, when it will rise again, and so on until delivery. After delivery, the pressure will re-

main a trifle high until about the third or fourth day, and will then again resume its normal condition.

As above stated, the use of the instrument cannot be too strongly urged in this condition, as it is perfectly obvious that by its use the dangers of Eclampsia are minimized.

Dr. Badger, in his "Some Blood Pressure Observations in Eclampsia," *Ibid.* pg. 607, says:

1. "The blood pressure in Eclampsia is high, and of diagnostic and prognostic importance.

2. "In spite of improvement in subjective symptoms and increase in the quantity of urine, the blood pressure will remain high.

3. "In this case prognosis is grave and labor ought to be induced.

4. "The continuance of high blood pressure during the puerperium warrants a grave prognosis as to complete recovery."

He further says that persistent elevation of blood pressure above normal during pregnancy, or the puerperium, is generally caused by arterio sclerosis, nephritis and eclampsia, that moderate elevations are found in arterio sclerosis and nephritis, but extreme hypertension is indicative of eclampsia even in the absence of albumin.

BLOOD PRESSURE IN NEUROTIC PATIENTS

The blood pressure in neurotic patients is generally quite high, and runs from 175 to 225 millimeters, with a low diastolic, but it differs from the pressure of the sclerotic patient by not being sustained, for it will be up one day and perhaps 20 or 30 millimeters less the next, but nevertheless it is a matter for very careful watching and consideration, as the danger to the patient with a high pressure, although intermittent, is manifest, and all possible dispatch should be used in removing the cause, and thereby the pressure will regain its normal condition.

The use of the Sphygmomanometer is perfectly obvious in these conditions, both from the diagnostic and prognostic standpoint, for not only can the diagnosis be made by the use of the instrument, but the patient's condition is definitely shown on each blood pressure reading.

BLOOD PRESSURE IN PARESIS

In the early stages of the disease the pressure does not depart very much from normal. However, in bedridden conditions, hypotension is excessive, and death can be foretold by rapidly falling pressure.

Of course, with any kidney complication, hypertension would be present.

BLOOD PRESSURE IN EXOPHTHALMIC GOITRE

There has been much difference of opinion as to blood pressure readings in this disease, some claiming that a high and others that a low blood pressure prevails. In such cases as have come under the writer's observation there has been but little variation from normal pressure shown. Janeway has, however, found in observation of a number of cases that a moderately high pressure exists, but is inclined to think that the extreme nervousness of this class of patients accounts for it.

Spiethoff, however, is very emphatic in saying that no constant changes in blood pressure show in this disease in lighter forms, but in severe cases, both high and low occur.

BLOOD PRESSURE IN DIABETES

In the early days of blood pressure readings it was thought that a hypertension existed in this disease, but this cannot be definitely depended upon as authoritative, as both high and low pressures have been found.

*Janeway says:—"I have seen both high and low pressure in diabetes. I believe the disease itself is without influence on arterial pressure, that the occurrence of chronic nephritis, arterio or angio sclerosis, as a complication, explains the hypertension, and that the resultant emaciation and brown atrophy, or fatty change in the heart, caused the hypotension in severe cases."

*Janeway's "Clinical Study of Blood Pressure."

BLOOD PRESSURE IN ANGINA PECTORIS (TRUE)

In this disease the use of the Sphygmomanometer is essential because a well defined hypertension is important evidence.

*Janeway says:—"Though some cardiac enlargements and a systolic aortic murmur, less frequently a mitral murmur, are common findings, in connection with the patient's account of his sensations, stamp the attack as really of this nature, yet in a certain number no anatomical change is discoverable by ordinary physical diagnostic methods. If then a blood pressure of over 180 millimeters be found anginoid pain can be held due to definite organic disease."

In attacks, however, the pressure may rise or fall. In these cases the diagnosis and prognosis depend greatly upon attacks. With patients having a great deal of pain, pallor of face and low blood pressure prognosis is grave.

If this disease is allowed to go on to its height, the end is identical with all, the patients falling down and expiring almost immediately.

BLOOD PRESSURE IN DIPHTHERIA, SCARLET FEVER, MEASLES, AND ACUTE RHEUMATISM

In all of these contagious diseases a sub-normal blood pressure prevails, averaging generally about 100 millimeters systolic and a correspondingly high diastolic during the severe part of the disease.

*Janeway's "Clinical Study of Blood Pressure."

HIGH PRESSURE FROM ALCOHOL AND TOBACCO

Alcohol seems to have but very little effect on the circulation, i. e., as far as the ordinary use of it goes, by that meaning a person who is accustomed to using a small and like amount each day. On the contrary an over-indulgence in it will cause the blood pressure to fall from weakening of both the heart and vasoconstrictor centers.

There is no question but that the heart muscles are weakened by the use of alcohol, and dilatation might follow, which would lead to a falling blood pressure.

Tobacco. In habitual smokers both systolic, diastolic and pulse pressure are raised and will be sustained for about an hour, after which it will return to its normal condition. In smoking a strong cigar or an old pipe it is most marked. There are, however, no disagreeable symptoms. With an occasional smoker a sharp rise of pressure can be noticed with accompanying palpitation.

BLOOD PRESSURE IN ANAEMIAS AND WASTING DISEASES

The blood pressure in wasting diseases is always low, with a high diastolic, accompanied by atrophy of the heart muscles and weakened heart action, blood pressure generally reading in these cases from 90 to 100 millimeters.

BLOOD PRESSURE IN EPILEPSY

During the attacks it has been very difficult to obtain authentic blood pressure readings, but it is generally understood that during the seizure there is a rapid rise in blood pressure, which as rapidly falls as the paroxysms cease. The fact that in epileptic coma, subsequent to convulsions, the blood pressure falls, is of diagnostic value in differentiating between that and uraemic coma, where it will still remain high.

The use of the Sphygmomanometer is clearly indicated in making this differentiation between these two cases.

BLOOD PRESSURE IN LEAD POISONING (PLUMBISM)

In this disease the blood pressure will be high, as in arterio sclerosis and nephritis, with a low diastolic reading, as lead intoxication produces changes in the arteries and kidneys.

Even without structural changes in the arteries and kidneys, plumbism, as shown by the colic alone will run a high blood pressure.

The use of the Sphygmomanometer is clearly indicated in this case, and particularly in obscure ones.

BLOOD PRESSURE IN URÆMIA

The use of the Sphygmomanometer in uræmia is absolutely necessary, for in all chronic cases the blood pressure is high and becomes more so as the tension rises.

Uraemic crisis can be foretold by a sudden marked rise in pressure. A quick fall of pressure in cases of contracted kidneys signifies complete failure of cardiac action. A persistent low tension has followed improvement under proper treatment.

BLOOD PRESSURE IN AURAL TINNITUS OR RINGING IN THE EARS

About fifty per cent of the cases of aural tinnitus are caused by high blood pressure, pressure ranging anywhere from 175 to 225 millimeters. It is always a wise technique in all aural operations to obtain the blood pressure reading before operating, as it is unsafe to operate with an accompanying high blood pressure.

BLOOD PRESSURE IN MANIA AND MELANCHOLIA

A very high blood pressure is noticed in melancholia, which rises and falls according to the severity of the mental symptoms. In acute mania, however, the pressure is generally sub-normal.

BLOOD PRESSURE IN AUTOINTOXICATION

The subject autointoxication covers such a large and varied field that it would be impossible to take it up in its entirety in this work. Blood pressure in this condition is often high, with low diastolic, but not generally sustained, as the condition often proves itself to be susceptible to simple treatment.

BLOOD PRESSURE IN SYPHILIS

Hypotension is generally present in this disease, the pressure generally being around 80 or 90 systolic, with a high diastolic, resembling other subacute and infectious diseases, with a very slight degree of cardiac insufficiency in its early stages.

BLOOD PRESSURE IN CHRONIC PARENCHYMATOUS NEPHRITIS

In chronic parenchymatous nephritis, hypertension also occurs, but is by no means so constant as in the interstitial form. In amyloid diseases, blood pressure is inconstant, sometimes high, sometimes subnormal.*

*Wilson's Med. Diag., p. 118.

REDUCTION OF BLOOD PRESSURE BY AUTO-CONDENSATION (HIGH FREQUENCY)

The reduction of hypertension is a matter of grave consideration to-day, and the various number of remedies tried are all more or less of some value, but it would seem, however, that auto-condensation, in all cases where it can be used, gives us the best results, as the treatment not only lowers the blood pressure, but the effect is sustained, as it has been very clearly demonstrated by good authorities on electro-therapeutics that serious cases of hypertension can be reduced to a normal condition by judicious use of the d'Arsonval current without any cardiac depression.

The Sphygmomanometer is absolutely indispensable in this treatment, for not only do you arrive at your diagnosis with its use, but you can tell exactly, as you give each treatment, just the amount of reduction and can at all times watch the effect and distribution of the treatment.

"Either a static machine or a Ruhmkorff coil or other high potential transformers, such as are used for X-ray work in connection with a resonator or so-called high frequency attachment, and with a properly connected auto-condensation couch with cushion and long metal condenser—these give us the requisite apparatus for administering the d'Arsonval treatment.

The apparatus should be provided with a hot wire meter for marking the dosage administered to the patient, and the patient should receive the current, preferably through the hands, from two electrodes, connected with the hot wire meter, which is in series with one side of a d'Arsonval apparatus. It must be recognized by all observers that when the current is properly administered from such apparatus, the current has distinct polar differences, while to a degree alternating in character. The dosage required for a 12 to 15 minute treatment, as indicated by the hot wire meter, should register from 350 to 500 milliamperes, and while this measure will vary in frequency or amperage, other things being equal, it serves a practical purpose for the regulation of dosage.

The administration to the patient upon a couch, with a metal condenser extending beneath the cushion for nearly the full length of the patient, is a matter of much importance, because it distributes the condenser effects upon one side of the d'Arsonval apparatus more evenly throughout the tissues of the patient.

William Benham Snow, M. D., of New York, says:

"A study of many cases of varying conditions of arterial tension, with and without organic changes in the structure of the arterioles and large glands, presents a variety of clinical pictures as to prognosis and respond to treatment by diet and physical measures, as shown by comparisons made by the Sphygmomanometer."

Dr. Snow has classified these as follows:

Class 1. "In the aged or feeble, with lowered resistance, advanced arterio sclerosis may be present without a corresponding evidence of hypertension, because of want of compensatory heart force. Extremely low sphygmometric reading is an indication, in this class, of failure of heart compensation, which may also be present with valvular lesion or with a dilatation without hypertrophy, occurring, as it so often will, in those who have discontinued athletic pursuits in which they had been excessive.

"In the investigation of arterial tension with the Sphygmomanometer, the presence or absence of compensation must always be considered.

Class 2. "General arterio sclerosis, usually occurring in those of advanced age, may be so resisting to administrations of auto-condensation, which usually lowers arterial tension, that no measure of relief can be afforded, as shown by the reading of the Sphygmomanometer. In these cases it is probable that not only the larger arterioles, but the peripheral arteries, are to a marked degree sclerosed. In these cases impedimenta cannot be averted.

Class 3. "Arterio sclerosis in those of advanced age, and occasionally at ages from 50 to 60, at first resists measures which affect arterial tension without producing cardiac depression, but yield more than the preceding class, and finally, under prolonged treatment, are reduced to a moderate degree of hypertension, with cor-

responding improvement in general health. In these cases, in which the reading at the outset is about 200 millimeters, as measured by the Sphygmomanometer, the tension may be scaled down in the course of a month or six weeks to 160 or 165, at which it may be maintained by regulation of diet and occasional treatments.

"This class of cases is usually of advanced arterio sclerosis, with a marked degree of cardiac hypertrophy, but judging from clinical results, it is probable that some of the vessels will respond to measures which vary vasomotor conditions, and by persistence, the tension might be reduced to normal. Such reduction, however, would be unsafe if dilatation were also present, as atrophy of the hypertrophied muscles would intervene, and the compensation of the muscles of the heart having an already dilated ventricle would be impaired. With a reduction from 200 to 160 or 165 millimeters, however, experience assures a condition of safety; (1) from the point of view of maintaining compensation, (2) by preventing accidents, apoplexy and nephritis, pending a continued high arterial tension.

Class 4. "This class includes cases of advanced arterio sclerosis in mature adults in ages ranging from 35 to 55, in which the tension may have scaled to 150 or 170 millimeters, associated or not with a commencing interstitial nephritis. In these cases 12 to 15 minute administrations of auto-condensation, employing 400 milliamperes of the high frequency cur-

rent, as indicated by the hot wire meter, will produce a marked fall in arterial tension, and if frequent treatments are given, together with a correction of diet, the tension will be reduced to normal.

"In these cases the cardiac hypertrophy is not apt to be marked, and the tension may be very safely lowered to the high normal from 120 to 130 millimeters and maintained there without danger of producing a want of cardiac compensation, but greatly to the relief of the patient.

"Albumin and cast may be present, usually disappearing from the urine, and a general sense of lightness and well-being replacing an opposite sense of weight and tension.

Class 5. "These constitute a class of cases with a condition of hypertension found usually in matured individuals at from 25 to 45 years of age, in which the Sphygmomanometer indicates the presence of a moderate degree of hypertension, ranging from 130 to 145 millimeters, but who respond promptly to the usual means which lower arterial tension without depressing the heart.

"In this class are represented the cases which are incidently found when under treatment for some other condition, but who do not apply for advice for any condition referable to the circulatory apparatus. These patients have, in but few instances, developed an atherosomatous or sclerotic condition of the arteries, but if a high tension be allowed to persist will soon

develop the same conditions as Class 4. In this stage, in most cases, the patients may be rendered normal, and with a proper regulation of habits and diet offer a favorable diagnosis as to the control and prevention of further advance to a degenerated stage.

"There is probably no class of conditions so insidious as the steady inroads leading to arterio sclerosis, and no field in which the physician's art can afford more service to humanity than in saving from future disaster the individuals in this class by checking an advance to degeneration which is sure to follow the persistence of hypertension and its causes.

Class 6. "In this class are included young adults who, in the college athletic field, have developed cardiac hypertrophy and hypertension from over-training in the college teams, or athletes and boxers who have in training, over-developed their muscular system with an induction of cardiac hypertrophy with an associated dilatation.

"Probably no class of cases has received less consideration than these, and of the error and consequences of the present extremes in college athletics the professional and lay mind do not seem to be cognizant.

"In these cases do we find, after a few years following their training career, a persistence of hypertension which, when the individual lapses into a sedentary business career, will be followed by a lowered arterial tension due to want of cardiac compensation, dilatation with-

out hypertrophy, or in favorable cases, it may persist from other causes of hypertension. A low Sphygmomanometer reading in this class of cases will not be accounted for by those who do not suspect the condition.

Class 7. "Cases of compensatory hypertension arise with conditions of parenchymatous nephritis, cirrhosis of the liver, fevers, or excessive exercise, may be present, with or without the existence of arterio sclerosis, usually occurring as a temporary condition.

"In this classification we have included a variety of conditions in which the study and management of hypertension is of great importance to the practitioner and greater moment to his patient.

"The physical measures used for the control or correction of hypertension may be divided into: (1) those which act upon the neuromuscular mechanism, as the d'Arsonval high frequency and static wave currents, heat and cold, radiant light and heat and carbonic acid baths; (2) those which increase the general metabolism, including the high potential currents, radiant light and heat, alternating heat and cold in those who respond and exercise; (3) those who regulate nutrition, eliminating from diet foods which induce or favor intestinal fermentation and furnish nutrition to deleterious germs, substituting nutritious foods that are most free from such properties and others which may destroy intestinal bacilli and fermentes.

"Treatment is by these measures either intervening or prophylactic. The measures which check tendencies to hypertension and directly lower tension intervene and those that control to prevent are prophylactic.

"The measures referred to generally induce responses without producing any depression of the heart or vital centers, but rather by inducing normal relations and activities.

"The methods of d'Arsonval, either by auto-condensation or auto-conduction, by either of which the patient is placed in a field of high potential stresses, the current of high frequency to greater or less extent surging through the tissues of the body, are remarkably active in lowering arterial tension. The lowering effect is probably induced by a complex action of the current (1) upon metabolism, promoting tissue combustion and elimination, as demonstrated by the marked increase of solids with the urine; and another effect upon the vaso-motor centers, by which means tension is promptly relaxed as determined by the Sphygmomanometer. A 12-minute administration of 400 milliamperes is, as a rule, followed by a fall of pressure equivalent to from 10 to 15 millimeters. In some instances there will be a fall as great as 50 millimeters, while in those included in Class 2 there may be no fall whatever after weeks of daily application.

"That this effect is produced without heart depression is demonstrated by the fact that aged patients having extremely high arterial

tension with no fall following long series of administrations employing 400 to 500 milliamperes by auto-condensation, have no indication of after depression, which is the rule in cases described in Class 2, those that do not respond to auto-condensation.

"Auto-condensation is indicated in all cases in which hypertension is not compensatory, and contra-indicated in all compensatory cases. The dosage as to time should be relative to the value of the apparatus employed, 400 to 500 milliamperes being as a rule administered for from 12 to 15 minutes, and repeated daily, while the tension resists, and later on alternate days, and finally on occasions when found above the range determined to be as low as is compatible with safety, as where there is danger in causing an atrophy of the cardiac muscles in cases having dilatation for failure of compensation is certain to follow in such cases.

"In normal individuals in which hypertension is in accord with the demands of body activity, the indication is to lessen such activities to prevent subsequent cardiac hypertrophy and later consequences, or keep them up when hypertrophy with dilatation is once established.

"When the hypertension is associated with parenchymatous nephritis, the treatment should not be by auto-condensation, but by employment of means which will promote elimination through the sweat glands and relieve the existing local congestion, as light baths, convective body hot air baths, or of less value hot water

and steam baths, administered daily and continued each time until commencing rise of body temperature or signs of fatigue occur, a mouth temperature of 101 to $101\frac{1}{2}$ ° F., being always an index to discontinue treatment."

REDUCTION OF BLOOD PRESSURE BY BATHS

That the reduction of blood pressure by baths is not only possible, but valuable, would seem to be indicated by the following letter received from Dr. Shotwell of Mt. Clemens, Mich.

"In pursuance of your request, I am sending in a report taken at random through a case back. A considerable number of the cases treated at the Colonial, Mt. Clemens Springs, Mich., are the gouty form of rheumatism.

"Many things have to be considered to determine the extent of the inroads of the disease. One of them is blood pressure. Then which is the best instrument? My first was one of the mercury instruments. It was good, but troublesome. You required an assistant and with too great pressure 'out goes the mercury.' The little Sphygmomanometer was brought to me, found it reliable, did not require an assistant and it is in daily use."

Following are some of the readings taken as far apart as opportunity permitted:

106 REDUCTION OF BLOOD PRESSURE BY BATHS

Mrs. A. E. B.	. . .	Age 54	July 11, 1910	135
Mrs. W. S. A.	. . .	Age 62	Oct. 18, 1911	120
Mrs. W. B.	. . .	Age 78	Nov. 11, 1910	146
			Oct. 18, 1911	140
Mrs. S. B. D.	. . .	Age 61	Sept. 13, 1910	200
			Oct. 7, 1910	160
Mrs. A. E. D.	. . .	Age 60	Sept. 7, 1910	140
			Oct. 13, 1910	137
Mrs. Mc G.	. . .	Age 58	June 4, 1911	200
			July 15, 1911	152
Mr. T. D. G.	. . .	Age 65	July 10, 1910	155
			Mar. 11, 1912	120
Mrs. J. L.	. . .	Age 53	Jan. 30, 1911	170
			Feb. 11, 1911	158
Mr. R. L. M.	. . .	Age 42	June 15, 1911	180
			July 2, 1911	150
Mr. F. M.	. . .	Age 43	Sept. 4, 1910	160
			Aug. 29, 1911	120
Mr. F. M.	. . .	Age 70	Aug. 8, 1910	200
			Mar. 11, 1911	160
Mrs. F. M.	. . .	Age 70	Feb. 1, 1911	190
			Age 71 Mar. 11, 1912	140

REDUCTION OF BLOOD PRESSURE BY MEDICATION

Nitroglycerin has been used in a great many cases to suddenly reduce blood pressure, but the action is fleeting and not sustained.

Sodium nitrite is probably used more extensively than any other one drug for reducing blood pressure, and when accompanied by the necessary diet and manner of living, with continuous treatment, the results are good.

Dr. Achard of Chicago, reports more than favorably on the use of veratrine and the use of the European mistletoe for reducing blood pressure, and states that he has had a sustained action from both of these drugs and recommends them highly in these conditions.

Potassium iodide acts much the same as sodium nitrite, and seems to be fully as popular.

In reducing blood pressure by any means, it is absolutely necessary that the patient's life, manner of living, etc., be taken into consideration. To be successful only a very light and suitable diet should be allowed.

Dr. William Benham Snow says of the importance of diet:

"It is an important matter how food enters the alimentary canal; thorough mastication is essential. How much food is of still greater importance. Moderation must be observed. Most individuals should eat much less and masticate much longer, and eat the food that

supplies the physical demands. There is no doubt that the engorgement of the alimentary canal, with poorly masticated food, favors constipation, gastric and intestinal indigestion and fermentation, and a multiplication of the ferments which enter into the blood and vitiate the system.

"While perverted habits of eating call for correction, what is of still greater moment to the individual is what the food taken consists of. What we eat and drink are questions of the greatest importance to every individual.

"The purpose of eating should be impressed upon everyone. We eat to live and carry out the purpose of our being. We do not live to eat and gratify our passion for luxuries and intoxicating beverages. The choice of foods as a prophylactic against arterio-sclerosis is a subject of greatest importance in the management of these cases. Probably no food is more craved by the omniferous animal man than animal food, and no food taken is more dangerous as an element inducing the conditions under consideration. This is probably due to the fact that in the digestive pabulum, meat products afford a better culture medium for the development of deleterious intestinal germs than vegetables, and furthermore, they may carry more dangerous germs into the alimentary canal than other foods. If possible in all cases, therefore, of advanced arterio-sclerosis, the meat as an element of diet should be practically eliminated, and nitrogenous vegetable foods in the form of

nuts, whole wheat and cereals, rich in proteid as beans, peas and corn be substituted.

"Probably no cause contributes more to the induction of hypertension than the indulgence of alcoholic beverages, particularly malt liquors.

"While some authorities have contended that alcohol plays comparatively little part in the induction of hypertension, careful experiments made by Stewart and others have demonstrated the contrary beyond question. Any physician who, for one year, will investigate the tension of every patient, will find that the man of careful habits at 65, who has abstained from alcoholic drinks, will generally carry a lower tension than the man at 45, who has indulged in such beverages. They are, therefore, the first things to be excluded from the diet of every individual who wishes to avoid the dangers of arterio-sclerosis."

"BLOOD PRESSURE IN THE PRACTICE OF MEDICINE AND IN LIFE INSURANCE"

*Abstract from paper by J. S. Lankford, M. D.,
San Antonio, Texas.*

"It was not long after the discovery of the circulation of the blood that hypertension of the vessels was recognized in a vague way by the profession and relief was sought by bleeding. This practice seemed to have been sufficient to the medical mind until early in the last century, when venesection fell into disuse. Interest in blood pressure became more pronounced, and a number of scientific men undertook the invention of various instruments for testing the pulse and the pressure of the blood in the arteries. Mercury and other instruments of various kinds were used with more or less success, but it is only recently that air pressure instruments, portable, convenient, and easily mastered, and quickly applied before the patient becomes nervous, have become available. Numerous comparative tests have proven that instruments of this class are sufficiently accurate for practical purposes.

"This instrument consists of a gauge indicating the pressure up to 260 mm.; a sleeve, in which is a rubber bag about $5\frac{1}{2}$ by $9\frac{1}{2}$ ", enclosed in a cloth cover, longer than the bag and tapering to 2" in width; and two rubber

tubes to be connected with the gauge and an inflating bulb.

"It is absolutely essential that the sleeve be at least $5\frac{1}{2}$ " wide, that the test be made in a recumbent position on a level with the heart, and that the left arm just past the elbow be used, so that the results may be uniform.

"If the sleeve is narrow and on inflation becomes almost like a cord, the blood will pound against it as against a solid wall, and the pressure will be at least 15 mm. higher. If the patient is upright, the weight of the blood will make a difference of 10 mm., and the left arm registers 5 mm. higher than the right. There must be some uniform standard of practice in order to utilize the findings.

"In making a test the sleeves should be applied comfortably loose, the gauge and bulb attached, and the bulb is repeatedly compressed until the pulse at the wrist is lost. Then when the pulse returns the indicator points to the systolic pressure.

"The diastolic pressure is found by loosening the valve and watching the decline of the indicator, and when the point of the greatest oscillation is reached the lowest mark of the hand shows the diastolic pressure, which is 25 to 40 mm. lower than the systolic.

"Normal blood pressure is controlled and regulated by the vaso-motor system, and it is interesting to note the safeguards that have been thrown around the "dome of thought," within the skull. Not only has the brain a sepa-

rate and distinct pressure apparatus in the ventricles and the cerebro-spinal fluid within the solid skull; not only is there not a single sympathetic nerve following the cerebral arterioles to dictate dilatation and a sudden influx of blood that might produce serious pressure on the delicate structures of that organ, but nature has provided for every possible contingency by other means when emergency arises, such as great anger, excitement, exertion, etc. The superficial circulation, under vasomotor influence, opens up instantly and receives a large supply of blood. By far the most important relief, however, is found in the enormous amount of blood that may flow in the direction of the least resistance, i. e., into the abdominal organs through the immediate influence of the splanchnic nerves and the greater solar plexus. In fact, this outlet is used most of all.

"It has been found by experiments upon animals that the controlling center of blood pressure is in the medulla oblongata. If the medulla is severed in the upper portion the pressure drops to a very low point. Then if the lower segment is stimulated the pressure will run up to seven times the normal. There are experimental evidences, however, to show that the lower neurons join in the control. It would seem that a system of normal blood pressure has been established which has its great "central exchange" in the medulla, assisted by the lower neurons, and that its purpose is not only the protection of the delicate organ of thought, sensation and motion, but through the

vasomotor constrictors and dilators to regulate the circulation of the blood in all of the organs and to take care of the secretion and excretion, digestion, metabolism, etc.

"One of the most interesting things, both in the practice of medicine and in life insurance, is the fact that the blood pressure is universally low in classical tuberculosis. Of 53 cases repeatedly tested, the pressure was very low in 50, and the other three were complicated by syphilis and general arterio sclerosis. In several cases where there were some degree of arterio sclerosis, apparently due to tuberculosis, there was a low pressure on account of exhaustion. So universally does the low pressure exist in tuberculosis that it is an invariable early diagnostic symptom, a very important point in life insurance.

"Twice in two years have I seen a rapid pulse low pressure, with no other kind of symptom, lead on in a few months to a rise in temperature and typical tuberculosis.

"From all experience I am fully convinced of the great importance of testing the blood pressure both in the practice of medicine and in life insurance, and do not hesitate to predict that it will become a universal requirement in life insurance work. It is certain that no progressive physician can afford to be without a good Sphygmomanometer in the diagnosis and treatment of acute or chronic disease."

Read before the Section of Medicine and Diseases of Children, State Medical Association of Texas, Amarillo, May 10th, 1911.

VISCERAL ARTERIO SCLEROSIS

Kemp ("Diseases of the Stomach and Intestines") says of this condition:

"Harlow Brooks calls to our attention that the presence of diminished visceral function, with occasional and otherwise unaccountable elevations of the blood pressure, should, particularly in connection with possible etiologic factors, lead to a suspicion of some localized, if not general, are of arterial diseases. When associated with pain or peculiar anginal character, location in some special organ may be within the range of possibility. I feel quite sure that careful observation of cases of obscure abdominal pain, paroxysmal in character, and associated with elevation of the blood pressure, will eventually make it possible to diagnose those generally unrecognized types of arterial disease, while in a stage when something may still be done for their alleviation or for the prevention of their further progress.

"Some of these patients give a history of nervousness, gastric catarrh, and pain, vomiting, and even hematemesis may occur. Meteorism and constipation are not uncommon. Pain over the pancreas, and intestinal functional disturbances have been noted. When such symptoms occur in a patient of low marked arterio sclerosis, and are relieved by iodids and nitrites, one is justified in diagnosing abdominal arterio sclerosis.

"Etiology.—Alcohol, nephritis, syphilis, old age, tuberculosis, tobacco excesses and toxemia are the chief causes.

"Perutz shows we must differentiate between angina pectoris and angina abdominis due to arterio sclerosis. I have recently seen several cases who have complained of pain in the epigastrium, belching, constipation and headache. The gastric analysis showed deficient hydrochloric acid secretion, and the pulse the characteristics of arterio sclerosis. Treatment afforded no relief until nitrites were administered.

"Gilbride reports a number of cases with symptoms of pain in the epigastric or umbilical region, rarely in the lower abdomen. This is increased by exertion and in some cases during digestion. Weakness, loss of weight, abdominal distention and belching are present. The bowels are constipated, or there is constipation alternating with diarrhoea, or occasional normal movements. There may be vertigo or disturbances of vision. The gastric analysis showed in most cases a deficiency of hydrochloric acid. In one it was nearly absent and in one normal. Stomach motility normal or increased. Lactic acid and Boas-Oppler bacilli were present. Cancer had been suspected. The radial pulse and blood pressure may show arterio sclerosis. In some cases there are no evidences of this, but there are two symptoms significant of abdominal arterio sclerosis — tenderness of the abdominal aorta with epigastric pulsation.

Some patients may have attacks of angina pectoris with pain referred to the epigastrium. The age of the patient is usually over 40."

Ortner has contributed to the subject, demonstrating the disturbances of the motor, secretory, and absorptive functions of the intestines due to arterio sclerosis, and Akin has reported several cases. Nitrites afford the most relief, with the addition of potassium or sodium iodide.

TYPES OF SPHYGMOMANOMETERS

The Sphygmomanometer has established a place for itself in the minds and equipment of all thorough and practical physicians. It has established itself because of its efficiency as an able assistant in diagnosis and prognosis.

It therefore remains for the physician to give careful thought as to what Sphygmomanometer he should use, and in this determination it is necessary that consideration be given to the service required of the instrument, and if for any cause a particular type of instrument fails in full value of service, then that type of instrument should not be purchased.

It is pertinent to at once give thought to what constitutes efficiency in a Sphygmomanometer, and, when thought is given, it equally suggests that a Sphygmomanometer, to give service, must fulfill three essential requirements, namely:

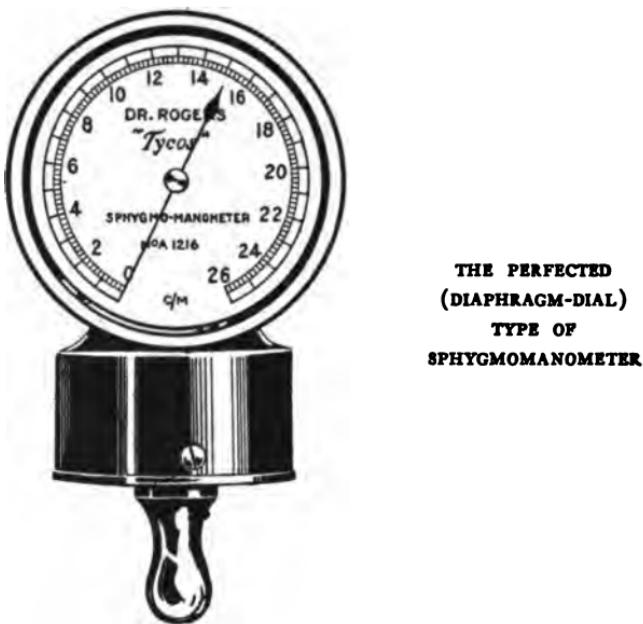
It must be competent to determine maximal or systolic pressure.

It must be competent to determine minimal or diastolic pressure.

And when these two are determined, the difference between the two establishes pulse pressure.

In doing this it is necessary that one should have clearly in one's mind the operation of the instrument to be used.

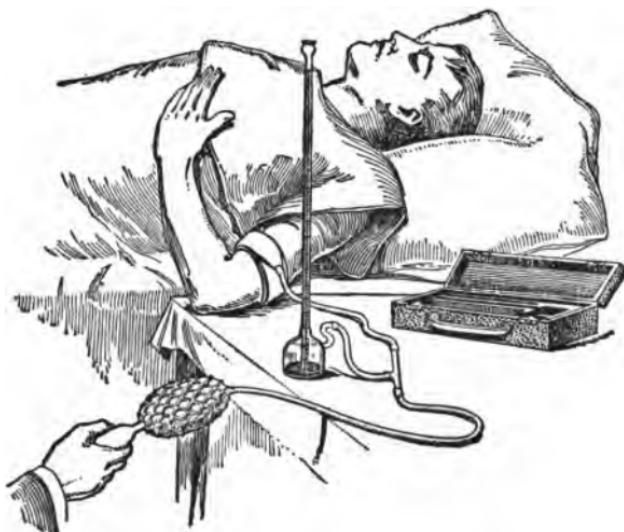
In determining maximal or systolic pressure almost any of the good instruments now pro-



THE PERFECTED
(DIAPHRAGM-DIAL)
TYPE OF
SPHYGMOMANOMETER

duced will give satisfactory results if they are in good condition, but to determine minimal or diastolic pressure is quite another question.

To properly determine minimal or diastolic pressure, the operation or action of the instrument must be *absolutely* coincident with each impulse of the heart. This can only be obtained with a well made diaphragm type of instrument, for the reason that there is no lost motion, and to prove this the physician only requires to place a stethoscope over the brachial artery and listen to the sound in the artery, noting the fact that the oscillation of the hand on the dial is absolutely coincident with the sound itself; whereas, in the mercurial type of instrument,



THE SIMPLEST FORM OF MERCURY SPHYGMOMANOMETER

the oscillation, if any, follows so slowly that the next impulse has appeared long before the oscillations have ceased, so that the real value of the oscillation is interfered with by the returning impulse.

This is thoroughly recognized by the most advanced men in research work.

The mercury column as cared for by the general practitioner cannot be kept clean, and foul mercury increases the capillary error.

The changes in capillarity destroying the original value of the scale (coming from the oxidation of the mercury) and the inability of the mercury column to indicate quickly the arterial impulse should be carefully thought of when considering the use of the mercury column as an arterial pressure gauge.

Mercury having such a tremendous inertia, due to its high specific gravity, cannot possibly receive and record the value of impulses as they occur. It is true that a mercurial instrument, when properly calibrated, the mercury being in good physical condition, will give correct maximal or systolic pressure, but it cannot express the value of minimal or diastolic pressure for the reasons given, and therefore can give the physician only one-third the value in actual service of the perfected diaphragm type of instrument.

Not only is this true, but the maximal pressure, when determined by itself, is liable to be misleading, and the physician who relies upon this service only cannot possibly get the true service of his Sphygmomanometer and is doing himself, as well as his patient, an injustice to rely upon such an uncertain interpretation when there is at hand an instrument that will give all the value required, and this is true of the diaphragm type of instrument, as it efficiently, when properly handled, determines all three pressures.

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BIBLIOGRAPHY

To the practitioner who wishes to make a more exhaustive study of the Heart and the Circulatory System, we would recommend the following:

"Diseases of the Heart and Aorta," Hirschfelder, J. B. Lippincott & Co., Philadelphia.

Dr. Hirschfelder's observations in blood pressure and diseases of the heart, and the relative importance of one to the other, are well worthy of study. His work is based on the result of a large number of observations in research work, carried on extensively throughout a great many years in different hospitals and laboratories.

"Diseases of the Heart," James Mackenzie, M. D., M. R. C. P., Oxford University Press, New York.

Dr. Mackenzie in this work gives the result of an enormous series of observations, and he has endeavored to facilitate the rapid inquiry into the meaning of any given symptom.

"A Clinical Study of Blood Pressure," Theodore C. Janeway, M. D., D. Appleton & Company, New York.

This book on Blood Pressure shows careful thought and gives considerable information on the different forms of Sphygmomanometers. His physiological and pathological causes for blood pressure variations, combined with his own results and those of other men, make this

book a very interesting one for the general practitioner.

"Medical Diagnosis," J. C. Wilson, M. D.,
Published by J. B. Lippincott & Co.,
Philadelphia.

This work of Dr. Wilson's, of almost 1,500 pages with illustrations and colored charts, is a most valuable aid. Dividing as he does under four separate headings the subject matter, the author has simplified the arrangement of the topics in a field of medicine which has assumed great magnitude and is of vital importance.

"Physical Diagnosis," DaCosta, Published
by W. B. Saunders & Co., Philadelphia.

The author has in this work endeavored to not only place a book before the professional public which would meet all the requirements of the more advanced physicians, but also those of the junior students.

Based as it is on the author's own lecture notes, and ten years' clinical experience, it covers the subject in a most practical way.

Arterio Sclerosis, L. M. Warfield, Published
by C. V. Mosby, St. Louis.

Dr. Warfield in this work has given to the Medical Profession, a very valuable addition to the literature on this subject and his work on Blood Pressure, in this book, confirmed by animal experiments is indeed valuable.

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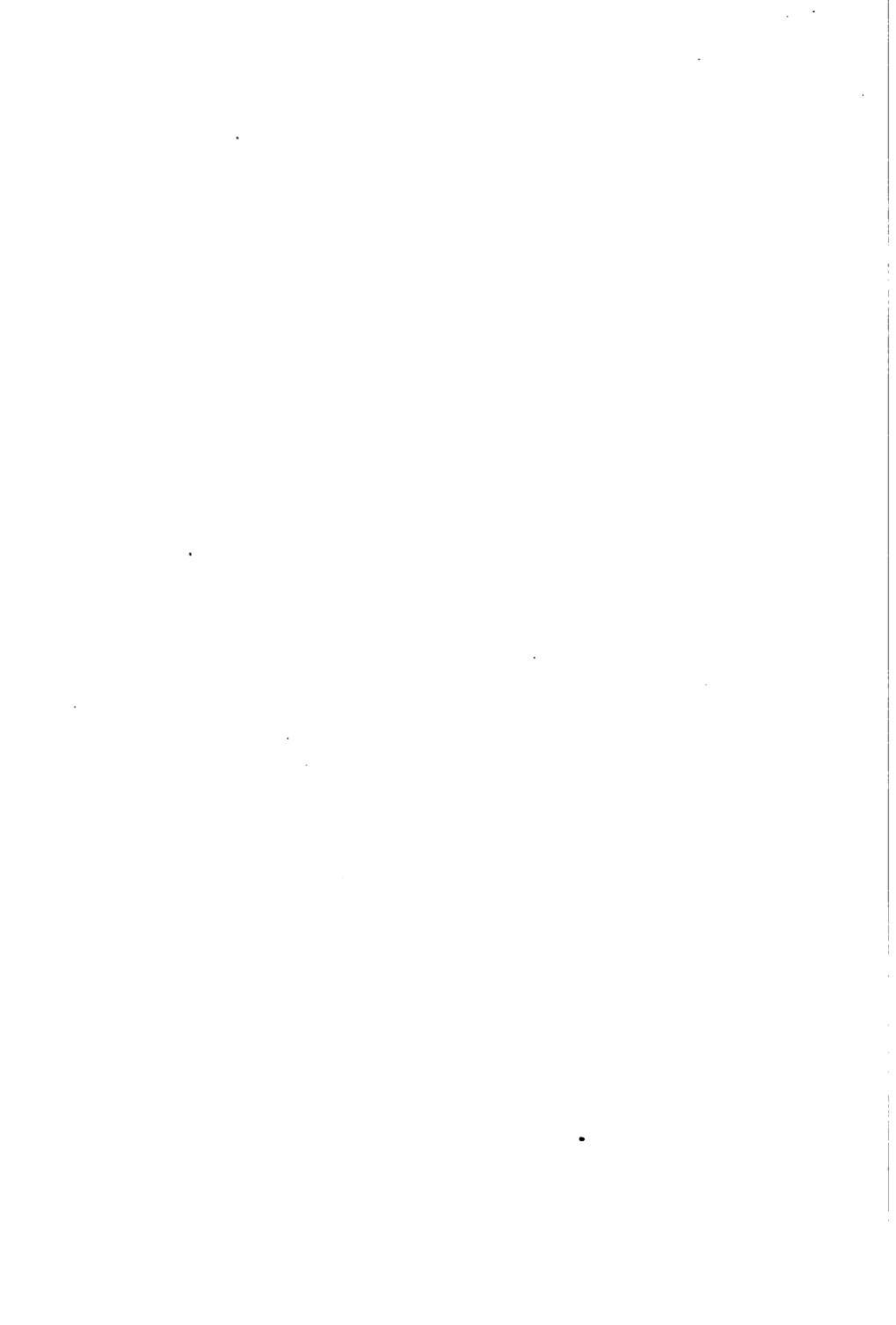
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